DOCUMENT RESUME

ED 424 091 SE 061 661

AUTHOR	DuFour, Marilyn Berry; Courter, Linda Kothera; Garvin, Dennis M.
TITLE	PARK-IT! Elementary School Land Laboratories in Toledo City Parks. Curriculum Activity Guide, Grades 2-3.
INSTITUTION	Toledo Dept. of Natural Resources, OH.; Toledo Public Schools, OH.
PUB DATE	1997-00-00
NOTE	84p.; Illustrated by Dennis M. Garvin. Project funded by grants from the Ohio Environmental Education Fund and the Toledo Urban Forestry Commission. For other documents in "Park-It!" series, see SE 061 660 and SE 061 662.
AVAILABLE FROM	Ottawa Park Nature Education Center, 2201 Ottawa Parkway, Toledo, OH 43606.
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Biological Sciences; Concept Formation; Cooperative Learning; Earth Science; *Environmental Education; *Field Studies; Grade 2; Grade 3; Hands on Science; Intermediate Grades; *Outdoor Education; *Parks; Partnerships in Education; Primary Education; *Science Activities; Science Education; Teaching Guides
IDENTIFIERS	*Land Laboratories; Ohio (Toledo); Stewardship

ABSTRACT

The project PARK-IT! represents a unique partnership between a public elementary school and a city park in which students and teachers utilize a small naturalized area of the park as a Land Laboratory, and in return become its stewards. The project also includes this curriculum activity guide which can assist teachers in using the Land Lab with students in grades 2-3. The guide begins with an explanation of the importance of a land laboratory, guidelines for taking students outside, and preliminary activities to prepare for going to the site. Activities are grouped by such subject areas as soil, water, plants and animals. Activities address such concepts as soil permeability, leaf composition, use of weather instruments for monitoring weather, snow and its effect on the environment and animal behavior, growth of propagated plants, native versus non-native plants, food preferences of neighborhood birds, and common insects that use plants. The activities include journal questions and extensions. The guidebook includes a summary chart of activities which contains an activity overview, purpose, science skills involved, and learning outcomes keyed to fourth and sixth grade proficiency tests. (PVD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 424 091

DEPARTMENT OF NATURAL RESOURCES
CITY OF TOLEDO

OEEF
OHIO ENVIRONMENTAL EDUCATION FUND

PARK-IT!

Elementary School Land Laboratories in Toledo City Parks

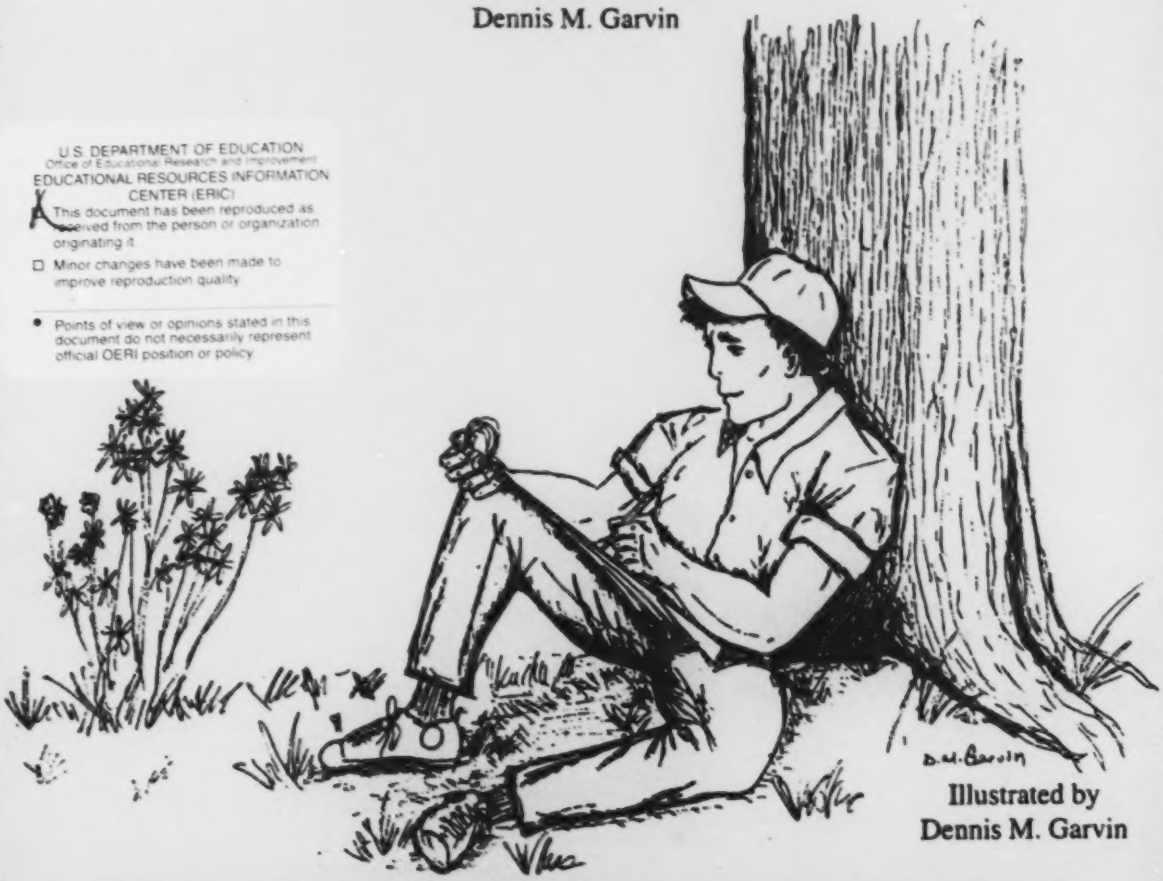
Curriculum Activity Guide
Grades 2 - 3

by

Marilyn Berry DuFour
Linda Kothera Courter
Dennis M. Garvin

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
D. Garvin
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
2B

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.



Illustrated by
Dennis M. Garvin

Unpublished work. Copyright ©1997. Marilyn Berry DuFour, Linda K. Courter and Dennis M. Garvin.

SE 061 061

This Curriculum Activity Guide is dedicated to all educators who strive to keep science in the field and nature in science.

Special thanks to all the elementary teachers of Toledo Public Schools who edited the draft of this resource and to the teachers and administrators who participated in the five "pilot" PARK-IT schools.

Unpublished Work.
COPYRIGHT © 1997
Marilyn Berry DuFour, Linda K. Courter and Dennis M. Garvin

All rights reserved. No part of this book may be reproduced or utilized in any form or by any means without written permission from the copyright holders. Permission is given to the individual classroom teacher to reproduce the student activity pages and data sheets for classroom use only. Reproduction of these materials for other teachers or for an entire school system is strictly prohibited without prior permission.

For information contact:
City of Toledo, Department of Natural Resources
Ottawa Park Nature Education Center
2201 Ottawa Parkway
Toledo, Ohio 43606
(419) 936-2876

Table Of Contents

Page No.

Introduction / Pre-Activities 1

Activities

Soil

Soil Permeability 11
Rate Of Decomposition Of Leaf Species 16

Water

Weather Station 22
Snow-How it Changes Life For Animals 32

Plants

Growth Of Propagated Plants 37
Native Vs. Non-Native Plants 46

Animals

Food Preferences
Of Neighborhood Birds 52
Common Insects Which Use Plants 58

Appendix

4th and 6th Grade Learning Outcomes 66

• • INTRODUCTION • •

Welcome to PARK-IT!: Elementary School Land Laboratories in Toledo City Parks! This project is jointly administered by the City of Toledo, Division of Forestry and Open Space Planning and the Toledo Public Schools and is funded by the City of Toledo and grants from the Ohio Environmental Education Fund and the Toledo Urban Forestry Commission. PARK-IT! represents a unique partnership between a public elementary school and a City Park in which students and teachers utilize a small (1/2- to 1-acre) naturalized area of the park as a Land Laboratory and, in return, become its stewards. The project also includes this Curriculum Activity Guide which will assist teachers in using the Land Lab with their students.

Why A Land Laboratory?

Using a natural area in a park or a schoolyard as a Land Laboratory is one of the easiest and most exciting ways to implement Ohio's Model Competency-Based Science Program. The Program, which defines basic scientific literacy as "the capacity of a person to be able to ask questions, collect information and make evidence-based decisions about scientific and technical issues in their [sic] own life", aims to promote scientific literacy through hands-on, inquiry-based learning which involves students working in cooperative groups (Cantrell and Barron, 1994). A PARK-IT! Land Lab accomplishes this on two levels: (1) through the guided inquiries outlined in this Activity Guide and (2) through the inquiry involved in managing the Land Lab as a natural area.

There is little doubt that one of the most important scientific issues that students will confront in their lives will be the health of the environment. The environment provides the basic needs of all living things and is a worthy focus of this Activity Guide as well as science education in general. By using inquiry to discover how soil, water, plants and animals interact and depend on one another, students will be better prepared to make decisions regarding our natural resources in the future.

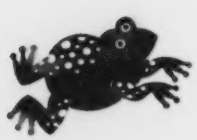
Although life science and earth science are the core subject areas examined in this Activity Guide, skills from other subject areas, including language arts, mathematics, social studies and the arts, are incorporated whenever possible. As you become more comfortable teaching your class in an outdoor setting, consider adapting some of your indoor lessons in all subject areas for use outside!

Taking Your Students Outside

Leaving the controlled environment of the classroom for the great unknown of the outdoors is uncomfortable for some teachers. It is hard to imagine that a scenario which appears to invite chaos can engage the students in a way that is difficult to replicate in a classroom! By following a few simple guidelines, you can ensure that your trip to the Land Lab results in a positive learning experience for you and your students (Johnson, 1985):

1. **Establish your rules before going outside.** Be certain that your students understand what is expected of them. They need to know what they will be doing and the time frame in which they will be allowed to do it. However, do not expect the level of order that you can maintain in the classroom. It is important to permit some "controlled chaos" so that your students can explore and improve their capacity to work independently with limited distraction.

2. **Be certain that your students are dressed properly for their time in the field.** Successful field experiences can take place in all kinds of weather if everyone concerned is warm and dry. When working in tall grass or forested areas, it is a good idea to wear long pants, socks and sturdy shoes regardless of the season. Long sleeves may also be necessary if any of the children are sensitive to contact with grasses or need additional protection from the sun. Have your students wear hats, sunscreen and insect repellent if you plan to be outside for an extended period or in Spring or Autumn when sun and insects are troublesome. Winter experiences require layers of clothing, a warm coat, a hat, gloves or mittens, and boots. If possible, inform your students of a field experience at least one day in advance so that they can come to school dressed appropriately.



3. **Be sure that your students have all of the necessary equipment.** Equipment will vary depending on the purpose of your field trip, but a clipboard with paper and pencil for writing, drawing or collecting data and a magnifying lens for exploring are standard. (See the Making Your Equipment section of the Introduction for instructions on how to make an inexpensive clipboard.) If enough students have knapsacks that they can wear, encourage them to carry their equipment on their backs to keep their hands free.

4. **Consider the physical comfort of your students and try to avoid unnecessary distractions,** especially when lecturing or leading a discussion. If you will be talking for longer than a few minutes, find a dry, comfortable place for the children to sit. The fence surrounding your Land Lab has been designed to support their weight and can be used for this purpose. Use shade on a hot day, and avoid having your students sit where the sun will be in their eyes. Keep your eyes open for potential hazards, such as ant colonies and poison ivy patches. If something more exciting than your discussion is happening in the park, you may want to save your discussion for the classroom or another time!

5. **Set clear boundaries before you turn your students loose to work or explore**. Describe verbally and point out visually the landmarks which outline the portion of the park which the children will be allowed to use. Walk the boundaries as a class if your students would find this helpful.

6. **Divide your students into working groups, and assign roles or tasks within each group to facilitate cooperative learning.** Roles will depend on the type of Activity that you have assigned but may include such titles as Coach or Leader, Recorder, Equipment Steward and Measurement Taker. It is important that the students have an opportunity to try a variety of roles and that they are not excluded from being actively involved in the hands-on Activity by what they have been assigned to do. With a little practice, older students will be able to organize their own group work in this way.

7. **Enlist the assistance of an older class or adult volunteers** if an Activity seems difficult to supervise. The extra pairs of eyes and hands can provide your students with the guidance necessary to ensure their success. Older students will also benefit from the opportunity to assume a leadership role.

8. **Seize the teachable moment.** Be flexible with your lesson, and allow your students' discoveries to become a part of it, even if they do not directly relate to the topic at hand. A praying mantis dropping in on your plant lesson could be the most memorable contribution to your students' science education that day. Use these unexpected events to their advantage.

9. **Do not be afraid to say "I don't know" when a student presents you with a mystery object or asks you a question**. The process of using your field guide library to find an answer together will be a valuable lesson for you and your students. Older students who have been oriented to the use of field guides will also benefit from the magic words, "Look it up!"

Making Your Equipment

Many teachers may be discouraged by the lack of equipment available to them for teaching science. Consequently, an apparent need for more specialized equipment can seem an insurmountable obstacle to taking your class outside. Do not let a lack of equipment discourage you. Scientific equipment does not have to be state-of-the-art. With a little creativity, you can improvise functional equipment which is both practical and inexpensive.

In most of the activities outlined in this Activity Guide, your students will be asked to make and use their own tools. Building a working model of a weather instrument or a composter has the important benefit of enabling your students to understand how the tool functions. The process exercises problem-solving skills which may eventually make it possible for your students to design their own tools. In addition, most of the projects in the Activity Guide reuse materials which would otherwise be thrown away or recycled, making them economical and environmentally sound.

As previously mentioned, clipboards and pencils are standard issue when your class will be writing, drawing or collecting data outdoors. Because the office supply variety of clipboard can be pretty expensive, you may want to consider beginning your students' tool making careers by having them build their own.

PRE-ACTIVITY #1:

Making A Clipboard

MATERIALS

For The Class
- Pencil
- Ruler
- Utility knife
- Scissors
- Permanent marker

For Each Student
- 23 cm X 30 cm (9" X 12") piece of cardboard
- #64 (3-1/2" X 1/4") rubber band
- 66 cm (26") piece of string or yarn
- Pencil
- Glue

Prepwork

Have your students bring in heavy corrugated cardboard from home until you have collected enough for one 23 cm X 30 cm (9" X 12") piece per student. Using the utility knife, cut the cardboard into 23 cm X 30 cm (9" X 12") pieces. Using the tip of the utility knife, poke a small hole for the string or yarn that you will be using in the corner of each piece of cardboard. The hole should be located approximately 2.5 cm (1") from the sides. Cut the string or yarn into 66-cm (26-inch) lengths, enough for one per student. Gather all other necessary materials.

PROCEDURE

1. Distribute a 23 cm X 30 cm (9" X 12") piece of cardboard, a rubber band, a 66-cm (26-inch) length of string or yarn, a pencil and glue to each student. Have each student orient his or her cardboard so that the hole which you poked is in the bottom right corner for a right-hander or the bottom left corner for a left-hander. Write each student's name across the bottom of his or her piece of cardboard with permanent marker.

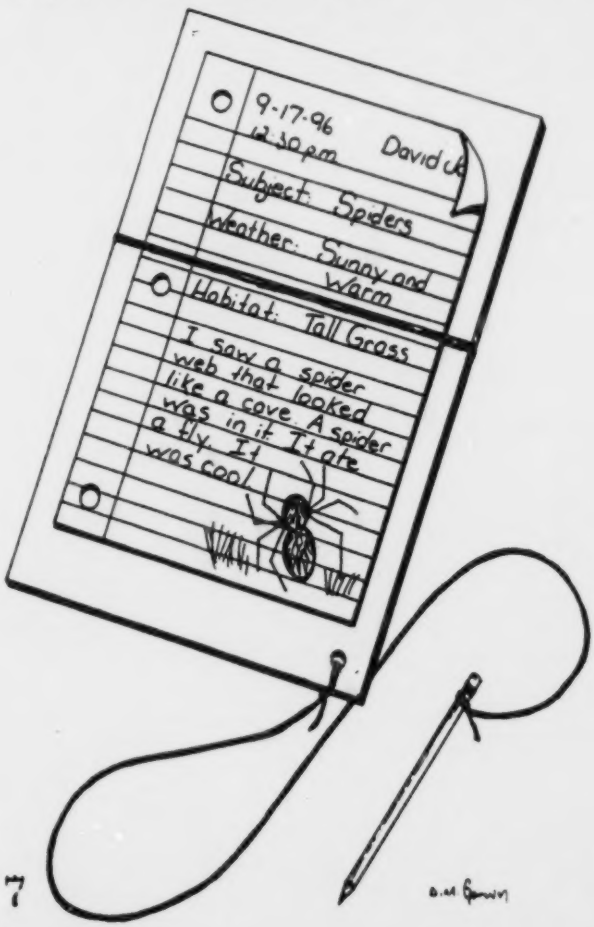
2. Have the students tie one end of their strings through the holes in their pieces of cardboard. Have them tie the other end of their strings to their pencils just above the erasers. Wrapping the string around the pencil twice before tying it and anchoring it with glue will prevent the string from sliding off the pencil when the clipboard is in use.

3. Have the students wrap the rubber bands around their clipboards. The rubber band will serve to hold a paper or Data Sheet in place.

4. Have the students tuck their pencils under their rubber bands for storage. Collect the clipboards for storage in a centralized location, or have your students store them in their desks.

• • •

Another standard piece of equipment which you should prepare for your use before using the Land Lab is a collection of marking stakes. Marking stakes can be used for a variety of purposes, including marking planting sites, setting working boundaries for your students and making other classes aware of a study area. You can make your own by cutting furring strips or other similar scrap lumber into 30-cm (12-inch) lengths and painting the top of each stake with fluorescent paint to increase its visibility. Using an angled cut to create a point on the bottom of the stake makes it much easier to drive into the ground. You should prepare one to two dozen stakes to start.


9-17-96
12:30 pm
David
Subject: Spiders
Weather: Sunny and Warm
Habitat: Tall Grass
I saw a spider web that looked like a cave. A spider was in it. It ate a fly. It was cool.

BEST COPY AVAILABLE

Finally, to facilitate the making of tools and maintenance of your Land Lab, consider purchasing or borrowing a hammer and encouraging your students to bring in "throwaways" from home for as long as available storage space allows. The hammer can be used for driving marking stakes and for simple maintenance and construction projects. The on-going collection of throwaways could include gallon milk jugs for carrying water; 5-gallon laundry soap, spackle and pickle buckets for carrying mulch and equipment; and heavy corrugated cardboard, scrap lumber, 2-liter pop bottles, half-gallon milk cartons and half-gallon juice cans for tool making. End rolls of newsprint can be obtained free-of-charge from the Education Coordinator at The Toledo Blade. By pooling your resources with those of other classes, you will easily realize the goal of having adequate equipment for teaching science in your Land Lab.

Respecting Habitat And Inhabitants

In creating a PARK-IT! Land Lab in the park adjoining your school, the City of Toledo and the Toledo Public Schools have allowed a new home for wildlife to grow. Our actions have extended an invitation to animals which utilize the type of habitat provided by the Land Lab to take up residence. With the invitation comes a responsibility to respect the habitat and the animals that will come to live in it. It is important to remind your students of this and to set an example when using the Land Lab.

1. **Use dropped leaves, fruit and flowers for your studies whenever possible**. When you are finished, encourage your students to return these things to the places where they were found, recognizing the importance of dead plants and animals to the soil and the circle of life in general. If you must use part of a living plant, take only what you need (one leaf, one twig) and remove the part with pruning shears or a similar tool instead of tearing it off. The clean cut minimizes damage to the plant's tissues. Return whatever you use to the Land Lab when you are finished with it.

2. **Teach your students to observe all animals from a safe distance,** a distance at which they are not perceived as a threat by the animals. This will enable them to observe the animals' normal behavior and not just behavior based on fear. For instructions on determining a safe distance from which to observe animals, see the Flight Distance Activity for grades K-1.

3. **Never disturb a nest.** Frequent visitation of an animal home constitutes harassment and can interfere with the inhabitants' efforts to feed or rear their young.

4. **Do your homework before allowing your students to handle any wildlife, including insects, earthworms and pill bugs.** Consult a resource which outlines humane handling and care of the species of interest such as *Animals Alive!: An Ecological Guide to Animal Activities* by Dennis Holley. Be sure to release the animals at the exact location where they were found and at a time when they will not be hindered by inclement weather or lack of food. Your example will form the basis of your students' future interactions with habitat and its wild inhabitants.

Getting To Know Your Land Lab

Your PARK-IT! Land Lab consists of one-half to one acre of City Park land enclosed by a split rail fence. The perimeter established by the fence is rectangular or square in shape, and the fence posts are set square to one another so that the posts can be labeled with x coordinates (letters) and y coordinates (numbers) on an x-y axis. These coordinates can be used by you and your students to locate planting sites and study areas and to compile a base map of the Land Lab.

Compiling a base map is an excellent way to become familiar with the contents of your Land Lab. By placing a large map of the Land Lab on a bulletin board in your classroom, you will be able to orient your students to areas in which you will be working. The map could be used to keep an accurate record of changes in the Land Lab as they occur. It would also be advantageous to create a master of the base map to photocopy for your students to include in their journals or to prepare an overhead transparency.

To begin mapping, you and your students will need to take some measurements. Measuring can be done with a tape measure or by providing each student with his or her own measuring tool: the length of a pace.

PRE-ACTIVITY #2:

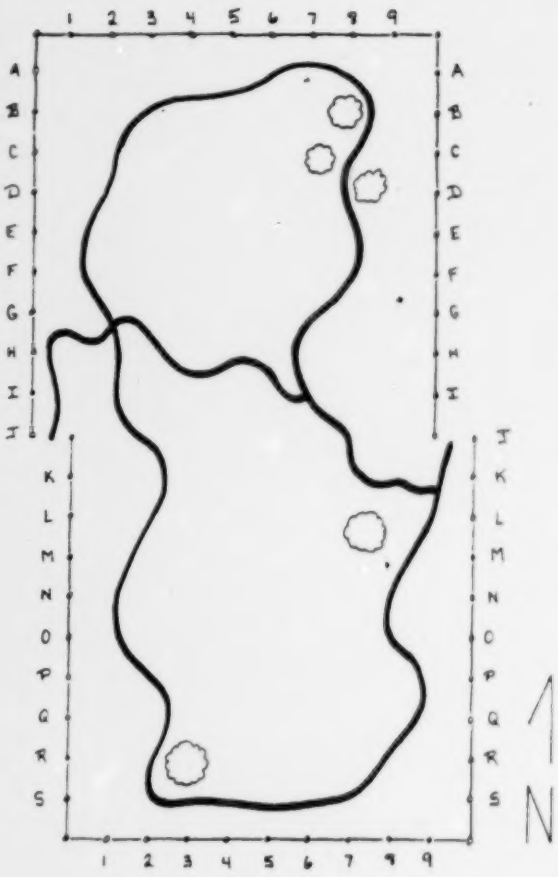
Determining The Length Of A Pace

Once you and your students have determined the length of each person's pace, you can use pacing to take the measurements necessary to compile a base map of the Land Lab.

MATERIALS

For The Class
- Tape measure or other measuring device
- Marking stakes (2)

For Each Pair Of Students
- Clipboard with pencil
- Scrap paper for calculations



PROCEDURE

1. Measure 30 meters (100 feet) with the tape measure or other measuring device, and mark off the distance with marking stakes.

2. Have your students line up behind one of the stakes facing the other. Explain to them that they will be walking the distance marked one at a time, beginning with their left feet and counting the number of times that their right feet hit the ground. A pace is equivalent to two steps. At your instruction, have each student count the number of paces required to walk the distance. Encourage your students to walk as normally as possible and to try not to make their steps bigger or smaller.

3. Have each student repeat the procedure three times and then calculate the average number of paces required to walk the distance. This is accomplished by adding the results of the three trials together and dividing by three.

4. Divide or have your students divide 30 m (100') by the average number of paces required to cover the distance to yield the length of one of their paces.

4. Have the students practice measuring unknown distances. Have them walk the distances while counting their paces and then multiply the number of paces required to cover each distance by the length of one pace. The students can also mark off a desired distance by dividing the distance by the length of one pace and walking the

PRE-ACTIVITY #3:

Compiling A Base Map

MATERIALS

For The Class

- Measuring tape or other measuring device (if pacing will not be used)
- Clipboard with pencil
- Scrap paper for recording measurements
- Large sheet of newsprint
- Meter stick or yardstick
- Permanent marker

For Each Student Or Group Of Students

- Clipboard with pencil
- Blank sheet of paper or grid sheet
- Ruler
- Crayons or markers for coloring, if desired

PROCEDURE

1. Have your students measure the perimeter of the Land Lab and the distance between the fence posts or points of intersection of the x and y coordinates. Measuring can be done with a tape measure or by pacing. Record the measurements on your sheet of scrap paper. Return to the classroom.

2. Establish a scale for the map A scale can be determined by selecting a desired size for the finished map and dividing the length of one of its sides by the actual length of that side in the Land Lab. For a large sheet of newsprint 2 meters in length, 2 meters may be divided by the length of the side of the Land Lab (64 meters) to yield a scale of 0.03125 meters or 3 centimeters to 1 meter of Land Lab.

$$\frac{\text{2 meters (size of the map)}}{\text{64 meters (size of the Land Lab)}} =$$

$$\frac{\text{0.03125 meter}}{\text{1 meter}} =$$

$$\frac{\text{3 centimeters}}{\text{1 meter}} \text{ or } \left[\frac{\text{1 inch}}{\text{3 feet}}\right]$$

3. For a sheet of typing paper 28 centimeters in length, 0.28 meter may be divided by the length of the side of the Land Lab (64 meters) to yield a scale of 0.004 meter or 0.4 centimeter to 1 meter of Land Lab. Multiplying through by 5 yields the scale in whole numbers: 2 centimeters to 5 meters of Land Lab.

$$\frac{\text{0.28 meter (size of the map)}}{\text{64 meters (size of the Land Lab)}} =$$

$$\frac{\text{0.004 meter}}{\text{1 meter}} =$$

$$\frac{\text{0.4 centimeter}}{\text{1 meter}} \times \frac{5}{5} =$$

$$\frac{\text{2 centimeters}}{\text{5 meters}} \text{ or } \left[\frac{\text{1 inch}}{\text{15 feet}}\right]$$

4. Return to the Land Lab with grids and clipboards with pencils to add details to the map. The procedure will vary according to the abilities of the students. Younger students can draw landmarks such as trees, stumps and trails as they appear within the rectangle or square. Older students can identify the x and y coordinates for each landmark and plot them on the grid. For an even more accurate map, have the students use the fence posts, marking stakes and string to construct a grid over each section of the Land Lab and corresponding square on the map. Encourage the students to label the map in as much detail as possible.

5. Upon returning to the classroom, allow your students to color their maps, if desired. Instruct them to include themaps in their personal science journals, if applicable.

• • •

Regardless of the method used, this mapping exercise will sharpen your students' math skills and introduce them to the physical layout of the Land Lab. To draw their attention to details that might not appear on the map, design and conduct a scavenger hunt with your students.

PRE-ACTIVITY #4:

Conducting A Scavenger Hunt

MATERIALS

For Each Student
- Clipboard with pencil
- Copy of brainstormed scavenger hunt checklist
- Crayons for coloring, if desired

PROCEDURE

1. Together with your students, brainstorm a list of scavenger hunt items that they would expect to find in the Land Lab. Write the students' ideas on the chalkboard. You may want to provide rough sketches of the items for younger students.

2. Have each student prepare a checklist of the items listed on the chalkboard using phrases and/or pictures. Checklists which include pictures may be colored, if desired. Distribute clipboards with pencils to your students, and have them attach their checklists to their clipboards. Go to the Land Lab.

3. Establish boundaries for the scavenger hunt, and outline any limits which you wish to place on collecting. Then turn your students loose to find as many of the items as they can. They will truly enjoy this initial unstructured time to explore.

4. Conclude the scavenger hunt by having the students share their findings. Did they find the items that they expected to find? Did they find the unexpected?

• • •

Caring For Your Land Lab

Your Land Lab encompasses a significant portion of a City Park. Like any City Park facility, it is for use by the citizens of Toledo and is therefore subject to wear and tear.

Each PARK-IT! Land Lab has signs posted near its entrances. These signs describe the PARK-IT! project, what a Land Lab is and how it is used and may be enjoyed. The signs also list guidelines for users to bear in mind. A sample of such a sign is shown below for your reference.

If you and/or your students notice fence rails are down, please return them to their original position. If fence rails or fence posts are broken or missing, please call the Naturalist staff at the Ottawa Park Nature Education Center at (419)936-2876. If vandalism is witnessed, please call 911 immediately and then inform the Ottawa Park Nature Education Center of the incident.

Trees which have been subject to vandalism or storm damage should also be brought to the attention of the Ottawa Park Nature Education Center. A dead tree may not be replaced, but an injured tree may be saved through trimming by the Naturalist staff.

The greatest threat to the trees of your Land Lab is insufficient and improper watering. Trees, especially young, newly planted ones, require a lot of water: as much as 10 gallons per week in the Spring and Summer. Water should be applied slowly. You can ensure sufficient watering at a desirable rate of flow by making watering buckets and instructing your students in their use.

Raymar School and Burnett Park
Introduce PARK - IT!
Elementary School Land Laboratories
In Toledo City Parks.
WELCOME!

This fence was built to enclose one half-acre of this City Park for use as a Land Laboratory. A Land Lab, or outdoor classroom, provides space and opportunities for children and all Toledoans to learn about environmental processes in a hands-on way. Children from nearby schools, scout groups, and community organizations use this Land Lab to see how the natural world works. Feel free to explore the Land Lab. For everyone's enjoyment, please:

1. Stay on the woodchipped trail(s).
2. Leave all plants and animals undisturbed.
3. Put trash in trash cans.
4. Observe all Toledo City Park Rules

BEST COPY AVAILABLE

PRE-ACTIVITY #5:

Making And Using Watering Buckets

MATERIALS

For The Class

- 5-gallon plastic bucket (1 per watering bucket)
- Electric drill
- 3/8" drill bit
- gallon milk jugs (5 per watering bucket)

PROCEDURE

1. Drill a 1-cm (3/8") hole in the base of each 5-gallon bucket. Your watering bucket is now complete! Fill the gallon milk jugs with water and cap them. Have your students carry the watering bucket or buckets and the milk jugs of water to the Land Lab.

2. Have your students place each watering bucket on the mulch mound over the roots of a subject tree. Have them pour 5 gallons of water from the milk jugs into each watering bucket. The water will slowly trickle from the 1-cm (3/8") hole, through the mulch mound and into the

• • •

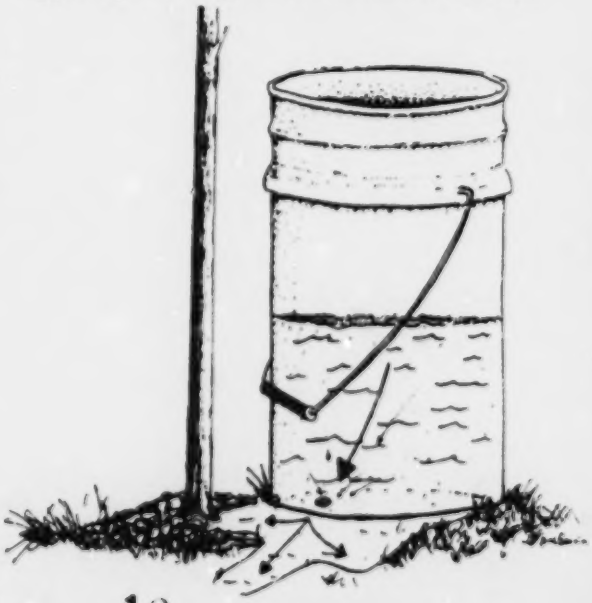
Woodchip mulch is an ideal material to apply on Land Lab trails. The woodchips reduce erosion and prevent plants from growing on the trail. Woodchips are our recommended mulch to place around newly planted trees and shrubs. Mulch prevents grasses and weeds from directly competing with trees for water. It also helps the soil retain water by reducing evaporation. When mulching beneath a tree, make sure the depth of the mulch bed does not exceed 10 centimeters (4 inches).

Woodchips are also an inexpensive way to prepare a planting bed for flowers or other plants which you and your class integrate into your Land Lab. After establishing boundaries of a potential planting bed site, spread a blanket of woodchips 10-15 centimeters (4-6 inches) deep over the area. The woodchips can be applied with 5-gallon buckets. Within a few weeks, the mulch will have killed the vegetation beneath it. Remove the woodchips from the area. Your planting bed is now ready for planting and regular watering. The woodchips which you have removed can be reused for other planting projects. Please call the Ottawa Park Nature Education Center if your Land Lab is in need of woodchips.

Using Your Land Lab

In addition to caring for your Land Lab, you and your students will share the responsibility of compiling a class journal. The class journal is one of the evaluation requirements of the PARK-IT! project. Its contents are left to your discretion but should document your class' use of the Land Lab through student writings, drawings, pictures and Data Sheets. In addition to allowing an outside observer to become familiar with your work in the Land Lab, the class journal will assist you with long-term record keeping. It will allow your current class to compare the results of their studies with those of any previous classes. This opportunity to compare could prove invaluable to your science teaching as the Land Lab grows and changes.

Although they are by no means required, you are also urged to assist your students in preparing personal journals. Like the class journal, the personal journal is probably best organized in a three-ring binder. This format enables your students to divide their journals into sections of handouts, writings, drawings or Data Sheets and to add information gathered in the Land Lab without having to take the entire journal outside. Encourage your students to decorate their journals, and set aside time during the course of each Activity to use them in some way. The students can use writing to focus their thoughts, to keep track of their learning, to plan how they will solve a problem, to take notes and comment on their reading and to reflect on their experiences (Hogan, 1994). If you or your students have trouble getting started or using the journal on a regular basis, you can consult the JOURNAL QUESTIONS section near the end of each Activity in this Activity Guide for a suggested journal entry which will reinforce the lesson.



As stewards of a PARK-IT! Land Lab, the role of your school's faculty, staff and students extends beyond basic maintenance and record keeping. You will all have a say in what the natural area actually becomes. By planting seeds and encouraging certain types of growth, you will be partners with the natural process of succession in creating a specific kind or kinds of habitat. Although management decisions will ultimately be made by your school's designated PARK-IT! Committee, you and your students should engage in on-going discussion about what you would like to see happen to the Land Lab. Submit your ideas to the Committee for consideration. If your suggestions meet with approval, encourage your students to follow through with them. Before initiating any planting project or on-going study, discuss the location with the PARK-IT! Committee to avoid disturbing the projects of other classes.

Your final responsibility as a steward of your PARK-IT! Land Lab is to utilize the Land Lab for the purpose for which it is intended: to provide quality hands-on science experiences for your students. You may have dozens of ideas on how to implement this or feel a little over-whelmed by the thought. The PARK-IT! Curriculum Activity Guides were written with both scenarios in mind. They include 25 activities, eight or nine per grade level grouping (K-1, 2-3 and 4-6). These activities focus on soil, water, plants or animals as they can be observed in the Land Lab and are written in a complete, easy-to-follow format. An explanation of the format follows.

The **TITLE** includes the subject of the lesson and a tongue-in-cheek subtitle for your entertainment.

GRADE LEVEL/TOPIC indicates the grade level grouping for which the Activity was developed and the broad category into which it fits: Soil, Water, Plants or Animals.

TIME REQUIRED/RECOMMENDED SEASON offers an estimate of the time which it will take to complete the Activity and the season of the year during which the Activity is likely to work best. It indicates if the Activity must be done in more than one session or is ongoing.

SCIENCE SKILLS lists those skills involved in the learning and practice of science which are used in the Activity.

KEY WORDS lists vocabulary which may be used to prepare your students for the Activity. These terms are highlighted in the BACKGROUND INFORMATION using bold type.

The **OVERVIEW** summarizes the Activity and indicates the types of learning experiences which are included. It suggests how the time required may be divided among these experiences to aid you in breaking the lesson into shorter segments which accommodate your time allocation for science.

The **PURPOSE** states what the students will do or be able to do as a result of completing the Activity.

MATERIALS provides an itemized list of the materials recommended to carry out the Activity and indicates whether they are needed for the class, for a group of students or for each individual student. The Prepwork section outlines those preparations which you will need to make to get the materials ready for use in the Activity. Improvising is encouraged!

The **BACKGROUND INFORMATION** provides you with some expertise in the subject of the Activity so that you can successfully brief your students prior to their participation in the Activity.

The **BEFORE YOU GO** section details the steps which you will take to prepare your students in the classroom before going outside.

The **PROCEDURE** is the body of the Activity which takes place in or focuses on the Land Lab. It is presented in a step-by-step format.

The **CONCLUSION** outlines a follow-up exercise or exercises for the classroom which provide closure to the Activity.

JOURNAL QUESTIONS suggests a way to use the students' personal journals to reinforce what they have learned from the Activity.

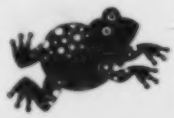
EXTENSIONS offers additional activities which you can use to build on what your students have learned if their interest indicates that they want to know more.

REFERENCES/ADDITIONAL READING lists literature cited and used to compile the Activity and other resources which you may find helpful in teaching your students about the subject matter. Books which are available at the Toledo/Lucas County Public Library are indicated by the initials TLCPL in parentheses. Most other titles may be obtained through inter-library loan.

CHILDREN'S SCIENCE/TRADE BOOKS lists children's literature which may be used in conjunction with the Activity. Books which are available at the Toledo/ Lucas County Public Library are indicated by the initials TLCPL in parentheses.

Some of the activities include Instruction Sheets for making tools, Data Sheets for collecting and recording data and other handouts for student use. Templates are included for most craft projects, and illustrations are found throughout the activities which clarify the text. For an overview of all of the activities in this Activity Guide, including titles, summaries, purposes, science skills and learning outcomes addressed, please consult the chart at the end of the Introduction.

Most of the activities in this Guide are guided inquiries. The explorations and experiments have been designed for you and your students. However, one of the desired outcomes of science learning is for your students to acquire the ability to design and plan their own explorations and experiments. Whenever possible, have your students use the background information which you have discussed with them to make predictions, or hypotheses, which can be tested during the course of the Activity. By highlighting the scientific process in each guided inquiry, you can provide your students with the confidence that they will need to strike out on their own. When they do, the possibilities for using your Land Lab will be endless.



Happy sciencing!

REFERENCES/ADDITIONAL READING

Cantrell, Diane C., and Patricia A. Barron, editors. 1994. Integrating Environmental Education and Science: Using and Developing Learning Episodes. Environmental Education Council of Ohio. Newark, OH. pp. 1-13. Available from Ohio Environmental Education Fund, Ohio EPA, P.O. Box 1049, Columbus, OH 43216-1049. (614)644-2873.

Ham, Sam H. 1992. Environmental Interpretation: A Practical Guide for People with Big Ideas and Small Budgets. North American Press. Golden, CO. 456 pp.

Hogan, Kathleen. 1994. Eco-Inquiry: A guide to ecological learning experiences for the upper elementary/ middle grades. Kendall/Hunt Publishing Company. Dubuque, IA. pp. 8-11. Available from Kendall/Hunt Publishing Company, P.O. Box 1840, Dubuque, IA 52004-1840. 1-800-228-0810.

Holley, Dennis. 1994. Animals Alive!: An Ecological Guide to Animal Activities. Roberts Rinehart Publishers. Niwot, CO. 301 pp. (TLCPL)

Johnson, Susan L. 1985. NatureQuest Leadership Training Manual. National Wildlife Federation. Washington, DC. pp. 21-24.

Ohio Department of Education. 1994. Ohio's Competency-Based Science Program: Scientific Literacy for the 21st Century. Ohio Department of Education. Columbus, OH. 116 pp.

Ohio Department of Natural Resources, program coordinator. Habitats For Learning: Ohio takes a new look at school land labs. Ohio Department of Natural Resources. Columbus, OH. 217 pp.
Available from Ohio Environmental Education Fund, Ohio EPA, P.O. Box 1049, Columbus, OH 43216-1049. (614)644-2873.

Wyzga, Marilyn C. Homes For Wildlife: A Planning Guide For Habitat Enhancement on School Grounds. New Hampshire Fish and Game Department. Concord, NH. 230 pp. Available from New Hampshire Fish and Game Department, 2 Hazen Drive, Concord, NH 03301. (603)271-3211.

PARK-IT!
Activity Summary

Title	Overview	Purpose	Science Skills	Learning Outcomes
	This Activity Consists Of ...	**The Students Will ...**		**See Appendix A**
K-1				
Soil Compaction *Puddles Under The Swing Set*	A demonstration of compaction, a field test of soil and a demonstration of how aeration improves soil quality.	Observe that well aerated soil absorbs more water than those soils which are compacted.	Observing, Comparing, Predicting	6,8,11,12,14,15,17
Animal Sign Census *Who Goes There?*	A comparison of the Land Lab and other areas of the park in terms of animal sign.	Identify animal sign and recognize that more sign will be found in the Land Lab.	Observing, Questioning, Record Keeping, Censusing	2,4,6,7,14,16,17
Splatter Testing *Keeping It Together*	A demonstration of erosion and its effects.	Observe the action of water on soil and the ability of vegetation to reduce this effect.	Observing	2,5,6,11,14,15
Soil Content *Sorting It Out*	A demonstration of soil particles, field test of soil and a game.	Be able to distinguish between different sizes of soil particles and predict that the largest ones are the heaviest.	Observing, Predicting, Collecting	1,2,6
Transpiration *Plants Don't Sweat. They Transpire*	A demonstration of water storage in plants, observation of a solar still and a worksheet.	Demonstrate that living plants store water and trace the path of water through a plant.	Observing, Questioning, Model Building	2,6,7,16
Evaporation *Which Way Did It Go?*	A search to find a place in the Land Lab where water will evaporate the most quickly.	Observe that water has three forms and name some factors which influence evaporation.	Observing, Hypothesis Testing, Questioning	2,5,6,7,8,11
Propagation *From Seed To Tree*	An introduction to types of tree seeds, selection and planting of and caring for seeds.	Recognize that fruits contain seeds and plant and properly care for tree seeds.	Observing, Collecting, Record Keeping	1,6,14,16,17
Flight Distance *I Need My Space*	Demonstrations of proximity, field testing of ideas and a game.	Show that animals need space.	Observing, Questioning, Measuring	2,3,5,6,8,12,16,17
Plant Parts *Look Ma, No Hands!*	Matching game with plants in the classroom and a scavenger hunt in the Land Lab.	Match illustrations of plant parts with plants in the Land Lab, and color those illustrations.	Observing, Record Keeping	2,4,6,7,8,16,17
2-3				
Growth Of Propagated Plants *How Does Your Land Lab Grow?*	An introduction to tree growth, measuring and drawing seedlings in the Land Lab.	Observe characteristics of a growing plant and produce a scale illustration of a plant based on data from the Land Lab.	Observing, Measuring, Mapping, Record Keeping	2,3,6,7,14,16
Soil Permeability *Down the Soil Drain*	Constructing a measuring device, field testing of the device and producing group reports.	Construct and use a measuring device to determine soil permeability and explain how land use effects the ability of soil to absorb water.	Tool Making, Observing, Data Collecting and Recording, Measuring	2,3,5,6,8,14,15,16, 17,18
Common Insects Which Use Plants *Look Who's Been Eating My Land Lab*	Building insect models, looking for insects in the Land Lab and follow-up discussions.	Give examples of insects which use plants and identify insect sign on plants.	Model Building, Observing, Identifying, Record Keeping, Comparing	1,4,8,16,17
Rate of Decomposition of Leaf Species *Now You See It. Now You Don't*	Making leaf rubbings as an aid to identification, building a mulch pile and monitoring the rate of decomposition of leaves from different species of trees.	Identify leaves from five different species of trees, compare and contrast the rates of decomposition of those leaves over the school year.	Observing, Collecting, Identifying, Record Keeping, Mapping	1,4,5,6,8,14,16
Weather Station *Whether We Like It Or Not*	Making and using simple instruments to monitor the weather.	Construct weather-monitoring devices and describe how the water cycle and temperature contribute to daily weather.	Observing, Data Collecting and Recording, Record Keeping, Monitoring, Measuring, Tool Making and Use	2,3,5,6,7,8,9,10 12,13,14

PARK-IT!
Activity Summary

Title	Overview **This Activity Consists Of ...**	Purpose **The Students Will ...**	Science Skills	Learning Outcomes **See Appendix A**
K-1				
Soil Compaction *Puddles Under The Swing Set*	A demonstration of compaction , a field test of soil and a demonstration of how aeration improves soil quality.	Observe that well aerated soil absorbs more water than those soils which are compacted.	Observing, Comparing, Predicting	6,8,11,12,14,15,17
Animal Sign Census *Who Goes There?*	A comparison of the Land Lab and other areas of the park in terms of animal sign.	Identify animal sign and recognize that more sign will be found in the Land Lab.	Observing, Questioning, Record Keeping, Censusing	2,4,6,7,14,16,17
Splatter Testing *Keeping It Together*	A demonstration of erosion and its effects.	Observe the action of water on soil and the ability of vegetation to reduce this effect.	Observing	2,5,6,11,14,15
Soil Content *Sorting It Out*	A demonstration of soil particles, field test of soil and a game.	Be able to distinguish between different sizes of soil particles and predict that the largest ones are the heaviest.	Observing, Predicting, Collecting	1,2,6
Transpiration *Plants Don't Sweat, They Transpire*	A demonstration of water storage in plants, observation of a solar still and a worksheet.	Demonstrate that living plants store water and trace the path of water through a plant.	Observing, Questioning, Model Building	2,6,7,16
Evaporation *Which Way Did It Go?*	A search to find a place in the Land Lab where water will evaporate the most quickly.	Observe that water has three forms and name some factors which influence evaporation.	Observing, Hypothesis Testing, Questioning	2,5,6,7,8,11
Propagation *From Seed To Tree*	An introduction to types of tree seeds; selection and planting of and caring for seeds.	Recognize that fruits contain seeds and plant and properly care for tree seeds.	Observing, Collecting, Record Keeping	1,6,14,16,17
Flight Distance *I Need My Space*	Demonstrations of proximity, field testing of ideas and a game.	Show that animals need space.	Observing, Questioning, Measuring	2,3,5,6,8,12,16,17
Plant Parts *Look, Ma, No Hands!*	Matching game with plants in the classroom and a scavenger hunt in the Land Lab.	Match illustrations of plant parts with plants in the Land Lab, and color those illustrations.	Observing, Record Keeping	2,4,6,7,8,16,17
2-3				
Growth Of Propagated Plants *How Does Your Land Lab Grow?*	An introduction to tree growth, measuring and drawing seedlings in the Land Lab.	Observe characteristics of a growing plant and produce a scale illustration of a plant based on data from the Land Lab.	Observing, Measuring, Mapping, Record Keeping	2,3,6,7,14,16
Soil Permeability *Down the Soil Drain*	Constructing a measuring device, field testing of the device and producing group reports.	Construct and use a measuring device to determine soil permeability and explain how land use effects the ability of soil to absorb water.	Tool Making, Observing, Data Collecting and Recording, Measuring	2,3,5,6,8,14,15,16, 17,18
Common Insects Which Use Plants *Look Who's Been Eating My Land Lab*	Building insect models, looking for insects in the Land Lab and follow-up discussions.	Give examples of insects which use plants and identify insect sign on plants.	Model Building, Observing, Identifying, Record Keeping, Comparing	1,4,8,16,17
Rate of Decomposition of Leaf Species *Now You See It, Now You Don't*	Making leaf rubbings as an aid to identification, building a mulch pile and monitoring the rate of decomposition of leaves from different species of trees.	Identify leaves from five different species of trees, compare and contrast the rates of decomposition of those leaves over the school year.	Observing, Collecting, Identifying, Record Keeping, Mapping	1,4,5,6,8,14,16
Weather Station *Whether We Like It Or Not*	Making and using simple instruments to monitor the weather.	Construct weather-monitoring devices and describe how the water cycle and temperature contribute to daily weather.	Observing, Data Collecting and Recording, Record Keeping, Monitoring, Measuring, Tool Making and Use	2,3,5,6,7,8,9,10 12,13,14

Soil

- Soil Permeability
- Rate Of Decomposition Of Leaf Species

Soil Permeability
Down The Soil Drain

GRADE LEVEL/TOPIC: 2-3/Soils

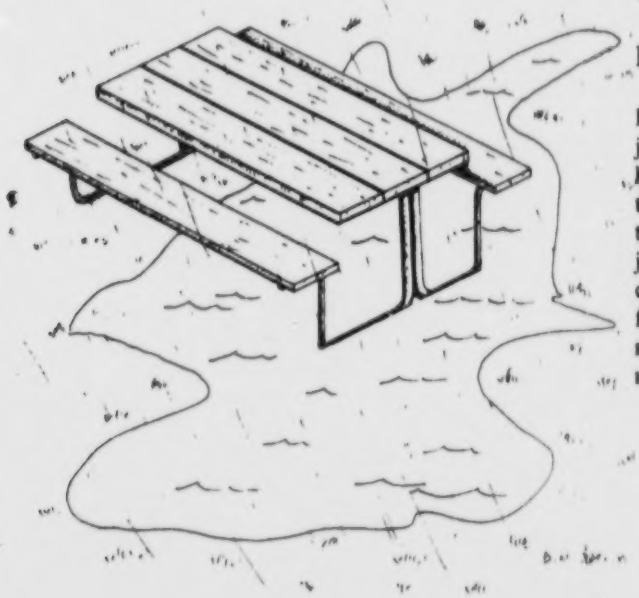
TIME REQUIRED/RECOMMENDED SEASON: 90 to 120 minutes/Spring or Autumn

SCIENCE SKILLS: Tool Making, Observing, Data Collecting and Recording, Measuring, Comparing

KEY WORDS: Permeability, Soil, Drainage, Compaction, Aeration, Graduated

OVERVIEW

This Activity explores the effect which various land uses have on the rate at which soil can absorb water using a measuring device constructed by the students. It includes a demonstration of air space in the soil and construction of the measuring device (30-45 minutes); field testing of the time required for soil to absorb water at selected sites in the Land Lab and the surrounding park (45-60 minutes); and comparison of the times required and small group reports (15-30 minutes). This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.



PURPOSE

1. Students will construct and use a measuring device to determine permeability of soil.

2. Students will explain how certain land uses/activities change the permeability of soil (i.e. moles, heavy equipment, recreation, etc.).

MATERIALS

For The Class
- Permeability Data Sheet master
- Clear 250-ml (1-cup) measuring cups (2)
- 125 ml (0.5 cup) of sand and/or soil
- 125 ml (0.5 cup) of water
- Rotary can opener
- 30-cm (12") section of board
- Hammer for inserting cans
- Pliers for removing cans

For Each Group Of 4 Students
- Half-gallon aluminum/steel juice can
- Permanent magic marker
- 500-ml (2-cup) measuring cup
- Ruler
- Masking tape
- Permeability Data Sheet
- Clipboard with pencil
- Gallon milk jug, filled with water and capped
- Empty gallon milk jug
- Funnel
- Stop watch or watch with timer or second hand
- Thermometer for measuring air temperature

Prepwork

Have the students bring from home large aluminum/steel juice cans until you have collected enough with the same height and width for one per group of four students. Have them bring in gallon milk jugs until there are enough for two per group of four students. Remove one end of each juice can and cover the edges with masking tape. Photocopy the Permeability Data Sheet until there are enough for one per group of four students. Fill half of the gallon milk jugs with water and cap. Gather all other necessary materials.

BACKGROUND INFORMATION

All living things need oxygen to survive. Therefore, soil as a habitat for a large number of living things must contain air. This air is found in spaces between soil particles, and, in general, the larger the soil particles, the larger are the spaces between them. (See the Soil Content Activity for grades K-1.) Air spaces are also increased by the action of worms, moles and other soil-dwelling animals, a process called **aeration**. Plants do not aerate the soil but depend heavily on the animals that do to provide space in which their roots can grow and breathe. Well aerated soils also make animal movement easier.

The amount of air space between soil particles also determines how quickly water can be absorbed into the soil. As demonstrated in the Compaction Activity for grades K-1, well aerated soil absorbs water much more readily than **compacted soil**. In this Activity, your students will actually measure the time required for water to be absorbed into the soil at various sites. They will do this using **graduated** measuring devices which they have constructed by marking regular intervals on the inside of a juice can. The rate of water absorption depends on the **permeability** of the soil, or the tendency of the soil to allow water to pass through it, and is expressed in terms of the volume of water absorbed, the area into which it is absorbed and the time required for absorption (milliliters per square centimeter per second or fluid ounces per square inch per second). If identical areas of absorption and volumes of water are used to make all measurements, then comparisons can be made using the time required.

The advantages of a permeable soil, such as that found in your Land Lab, are many. If water is absorbed readily into the soil, standing water will not be left at the surface to provide breeding grounds for mosquitoes or to allow potable ground water to be lost to evaporation. Absorption also helps to prevent runoff and erosion at the surface and improves air circulation by displacing older air and creating room for fresher air when the water drains. **Drainage** in soil is a process by which natural channels, or air spaces, gradually draw off water from one area to another. If permeability is coupled with the ability to retain water, then the water will be available for use by plants and animals living in the soil.

BEFORE YOU GO

1. Discuss with your students the importance of air and water to soil and its inhabitants as outlined in the background information. Define permeability as a property of the soil which affects how much water it can absorb and hold.

2. Demonstrate the presence of air in the soil by pouring 125 milliliters (0.5 cup) of water into a clear measuring cup containing 125 milliliters (0.5 cup) of soil and showing that, combined, they do not equal 250 milliliters (1 cup). Have your students measure the volume of air in the soil by using the markings on the measuring cup to determine the amount of water above the soil level. Explain that the water below the soil level has been absorbed into the air spaces.

3. Divide the class into small groups of four students, and distribute a juice can, permanent magic marker, measuring cup, ruler, masking tape, funnel and gallon milk jug of water to each group. Have each group construct a measuring device.
(1) Using the ruler and magic marker, mark a line on the inside of the juice can 5 centimeters (2 inches) from the bottom, and fill the can with water to the line.
(2) Fill the measuring cup with 250 milliliters (1 cup) of water(1 cup = 8 fluid ounces), and pour the water into the can. Mark a line on the inside of the can at the water level. Try not to touch the water with the marker; make the mark slightly above the water level.
(3) Repeat this procedure until the can is filled. When the entire can has been graduated, use the funnel to empty the can back into the gallon milk jug.
(4) Have your teacher remove the other end of the can with a can opener. Cover the edges of this end of the can with masking tape.

4. Describe and demonstrate the measuring process to the students and assign roles within each group. Two students will push and twist the can into the ground to the 5-cm (2") mark. Two students will measure and add water of known volume to the can. One student will announce "Pour!" to begin the experiment and keep time, and one student will record all findings on the Data Sheet. Some of the students will need to assume more than one role.

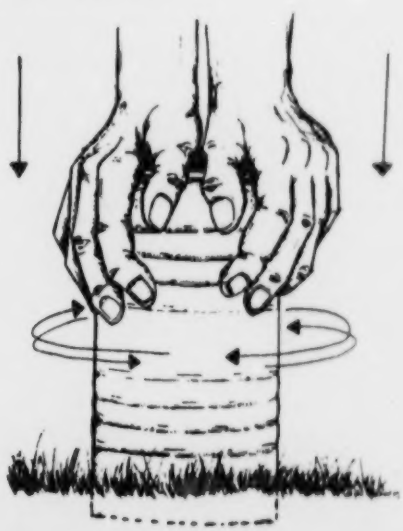
5. Distribute Data Sheets, clipboards with pencils, empty milk jugs and thermometers to the groups. Have the groups take all this equipment, as well as their measuring cans, measuring cups and funnels with them. You take the section of board, hammer and pliers. Go outside.

PROCEDURE

1. With your students, identify several sites inside and outside the Land Lab with different land uses: sporting areas, high traffic areas (i.e. drinking fountains), areas with different types of vegetation (i.e. trees, weeds, tall grass, mowed grass). Assign one group to each site. Use one site to demonstrate the process if necessary.

2. Have each group describe their assigned site, including the air temperature, on the Data Sheet and measure the time required for water to be absorbed into the soil using their measuring device. Instruct the students to push and twist their cans into the ground to the 5-cm (2") mark. You can assist them if necessary by placing the section of board over the top of the can and driving the can in with the hammer. Have the students use the measuring cup and funnel to measure the volume of water which their can holds to its top mark into the empty milk jug. **This volume should be the same for all groups**. At the direction of the time keeper, have the assigned students pour this known volume of water quickly into the can. The volume of water added and the time required for the water to be completely absorbed should be written on the Data Sheet by the recorder.

3. When all groups have finished making their measurements, remove the cans from the ground with the pliers, and return to the classroom.



CONCLUSION

1. Explain to your students that because all of the groups used the same size can and the same volume of water, they can compare the rates of water absorption for the different sites by comparing the times required for the water to be absorbed. Instruct the groups to circle the time required on their Data Sheets.

2. Have each group prepare a report to the class. Suggest that they describe their site, report their results and offer an opinion as to whether or not the soil they tested is a good habitat for plants and animals. Why or why not? Summarize all of the groups' results on the board so that the students can compare and contrast the findings. Discuss these findings as a class.

JOURNAL QUESTIONS

What land uses would you recommend for your school yard or park to make the soil a better habitat for plants and animals?
How would you prepare an area to grow plants if it had previously been a path?

EXTENSIONS

1. **Graphing.** Have each student prepare a bar graph of the class results with the sites studied on the x axis and the times required for the water to be absorbed on the y axis. Discuss how graphs can assist the students in making comparisons.

2. **Soil In The Cold.** Have your students leave their measuring cans in the ground until after the ground freezes and repeat the Activity during the winter months. Do the colder temperatures have an effect on the permeability of the soil?

3. **Read Between The Lines.** Have your students measure the amount of time that it takes for the volume of water in their can to decrease from one mark to the next. Is the rate faster or slower for a full can than one that is nearly empty?

REFERENCES/ADDITIONAL READING

Foster, Albert B., and Adrian Fox. 1970. Teaching Soil and Water Conservation: A Classroom and Field Guide. U.S. Department of Agriculture Soil Conservation Service. Washington, DC. pp. 5-6.
Available in limited quantity from Lucas Soil and Water Conservation District, 130-A West Dudley, Maumee, OH 43537. (419)893-1966.

Roth, Charles E. 1984. The Plant Observer's Guidebook: A Field Botany Manual for the Amateur Naturalist. Prentice-Hall, Inc. Englewood, NJ. pp. 83-85.

Swan, Malcolm D., editor. 1987. Tips and Tricks in Outdoor Education, fourth edition. The Interstate Printers and Publishers, Inc. Danville, IL. pp. 75-77.

CHILDREN'S SCIENCE/TRADE BOOKS

dePaola, Tomie. 1977. The Quicksand Book. Holiday House. New York, NY. (TLCPL)
Discusses the composition of quicksand.

Pringle Laurence, author. Peter Parnall, illustrator. 1973. Twist, Wiggle and Squirm: A Book About Earthworms. Let's-Read-And-Find-Out Series. Thomas Crowell. New York, NY. (TLCPL)
From why earthworms are found on the sidewalk after a rain to details of how and where they live and what they eat, this book presents an interesting look at an important form of animal life.

Ryder, Joanne, author. John Schoenherr, illustrator. 1976. Simon Underground. Harper and Row. New York, NY. (TLCPL)
As winter approaches, Simon the mole begins digging under the ground to build the tunnels where he will live throughout the winter. There he lives until he is able to emerge in the spring.

Data Sheet

Soil Permeability

Date _____

Names _____

_____

1. **Description of Site** (soil, plants, land use)	2. **Air Temperature** °F °C
3. **Volume of Water** ml Fluid Ounces Cups	4. **Time Needed to Absorb Water** Minutes Seconds

5. Do you think this site is good habitat or bad habitat? (Circle One)

6. Explain why you thought the site was good or bad habitat.

22

Rate Of Decomposition Of Leaf Species

Now You See It, Now You Don't

GRADE LEVEL/ TOPIC: 2-3/Soils

TIME REQUIRED/RECOMMENDED SEASON: 75 minutes, then 30 minute periods monthly throughout the school year/early Fall

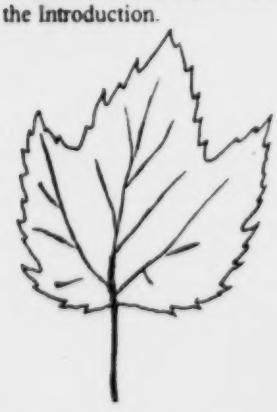
SCIENCE SKILLS: Observing, Collecting, Identifying, Record Keeping, Mapping, Comparing and Contrasting

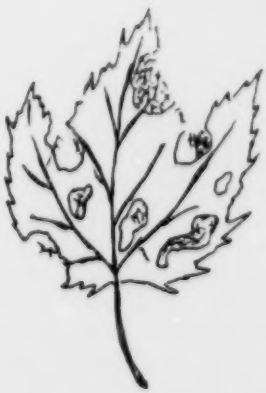
KEY WORDS: Soil, Composting, Decomposition, Decay, Species, Leaves, Landfills, Mulch, Food Chain

OVERVIEW

In this Activity, the students will be making leaf rubbings to help them identify five different tree species (45 minutes). The students will then set up (30 minutes) and monitor (6-8 visits of 20-30 minutes each) the rate of decomposition of leaves from those five species of trees.

Note: Each part of this Activity can be done separately, if desired. If this is your first Activity, please consult the Introduction.





Rate of Decomposition

PURPOSE

1. Students will identify five or more species of trees by leaves and create a field guide of their rubbings.

2. Students will compare and contrast decomposition rates of leaves from different species of trees over the course of a school year.

MATERIALS

For The Class

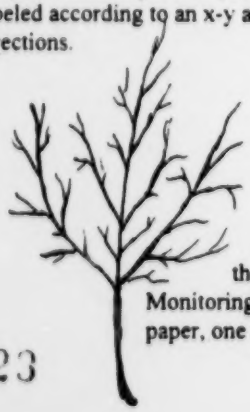
- Leaves of up to five species of trees, collected from the ground around the park or Land Lab, for Leaf Field Guides (2-3)
- Leaves of same five species as above, for experiment (30-60)
- Woodchip mulch, from the Land Lab
- Shovel, or several small trowels
- 5-gallon buckets (3-5)
- Gallon-size zip locked bags (5) OR 5 more 5-gallon buckets
- Stapler
- *Trees of North America* (in your PARK-IT! Library)
- Large, peeled, broken crayons of several different colors (5)

For Each Student

- Half-sheets of white paper (letter sized) (5)
- Half-sheets of construction paper (2)
- Data Sheet
- Leaf Monitoring Sheet
- Crayons
- Pencil

Prepwork

Before this Activity, find (but do not prepare) an undisturbed area within the Land Lab to locate the decomposition plot. This plot will measure about 1 x 2 meters (3 x 6 feet). If the fenceposts in your Land Lab have not been labeled according to an x-y axis, see the Introduction for directions.



While in the Land Lab, collect 2-3 leaves each from up to 5 trees for the Leaf Field Guides. Cut the white paper and construction paper in half before this Activity. Photocopy the Data Sheet and Leaf Monitoring Sheet on the same sheet of paper, one per student.

To learn about the differences between leaves your class will be using for this Activity, the students will make a Leaf Field Guide. Set up five stations (one per leaf) by gluing (a gluestick works great) the best representative of each species onto a piece of cardboard. Glue each leaf onto an old manila folder cut to the size of a half sheet of paper and then gluestick the folder to a clipboard. This will keep the top part of the paper secure. The manila folders pull off of the clipboards easily afterwards if one uses glue sticks to attach them. Assign a number and a color of crayon to each species, and write on the board the number and species of each leaf using the color the students use to do their rubbing. This way, the students can label their books while at their desks, preventing congestion at the rubbing stations.

Distribute a half sheet of white paper for each tree species, two half sheets of construction paper and the Data Sheet to each student. Bring the class up in groups of four or five to make rubbings for pages of their field guides while the rest of the class decorates the front and back covers for their books. Use large, peeled broken crayons held sideways to rub the image of the leaf. Have the students write the name of the tree species on each page. When covers and all rubbings are done, fold the Data Sheet and affix it to the inside of the back cover. Staple the books together.

BACKGROUND INFORMATION

Topsoil comes from decaying organic matter such as leaves. **Decomposition** is natural and forms our valuable topsoils by changing organic matter into a form which is easily used by plants. Beneath this top layer of **decay**, the soil is of less quality, which is why erosion of topsoils is an important environmental issue.

Decomposers are a group of living things that share the important characteristic of consuming dead plants and animals. Decomposers are an important part of the **food chain** and include fungus, bacteria and invertebrates such as sow bugs, centipedes, millipedes, worms, slugs and beetles.

Leaves differ in the rate at which they decompose. Dogwood leaves, for example, decay relatively quickly (within a few weeks). Oak leaves, in contrast, decay quite slowly and it is not uncommon to see them on the forest floor almost a year after they have fallen. The tough oak leaf is part of a line of defenses an oak tree has against plant-eating animals, usually insects. Having thorns or unpalatable tissues help plants ward off would-be herbivores.

In this Activity, students will be burying leaves from different **species** of trees in mulch to see how quickly they decompose. Mulch consists of woodchipped street trees. Burying leaves may seem reminiscent of how humans dispose of their trash. **Landfills** are supposed to be a way for us to bury our solid waste and have that waste decompose to harmless soil. However, as most people know, this is not the case. Readable newspapers from 50 years ago have been pulled out of landfills. Even with recycling programs in most areas making it easier than ever to recycle, much of the landfill waste consists of items that take hundreds of years to break down. Thus, landfills are not a long term solution to our solid waste problems. The only way for our trash to take up less space in existing landfills is to live "the three R's" - reduce, reuse and recycle. The office of Keep Toledo/Lucas County Beautiful (See Government listings in the phone book) can answer many questions about recycling.

Another item that takes up large amounts of space in landfills is yard waste. As mentioned above, the process of decomposition allows dead plants and animals to be changed into a form that is usable for growing plants. Carting yard waste off to a landfill interrupts this process and slowly depletes soils of nutrients. Yard waste is now banned from landfills, which gives people a great opportunity to learn about **composting**. Composting one's yard waste provides free, organic fertilizer that is as good or better than anything one could buy at a store.

BEFORE YOU GO

1. Review distinguishing characteristics of each species' leaves using the *Trees of North America*. The emphasis of this Activity is more on the decomposition process than identifying individual species of trees.

2. Complete Leaf Field Guides as per instructions in Prepwork section.

3. Discuss how leaves falling in the Land Lab will help make soil. Mention that some leaves will turn into soil faster than others, and that this Activity will help the students see how this process occurs over time.

4. Introduce the concept of landfills by asking what happens to the trash that the students themselves generate. Explain to students that because garbage does not really decompose in a landfill, humans are eventually going to run out of landfill space. We have to take it upon ourselves to reduce the amount of waste that goes into landfills.

5. To facilitate collection of leaves in and around the Land Lab, tape one example of each species on each bucket or baggie for field identification.

6. Have students bring their own Field Guides to help them identify leaf species. Bring a copy of the Data Sheet for you to record the location of the decomposition plot. Take class outside.

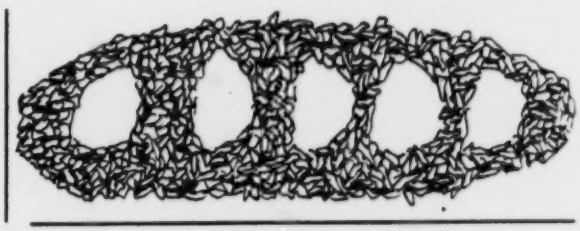
PROCEDURE

1. Have each student collect 5 samples of each species. Only collect leaves on the ground, please. Students should place their leaves in the appropriately marked bucket or zip locked bag and carry the containers to the Land Lab.

2. Using the empty buckets, have students spread woodchip mulch over a predetermined area of the Land Lab measuring 1 x 2 meters (3 x 6 feet) and a depth of 8 centimeters (3 inches).

3. Empty the contents of each leaf container on the bed of wood chips. The leaves should be more or less end-to-end, not in a pile. Once this process is completed, mark the location of each species of leaf on a map sheet. Be sure to note where the plot falls on the x-y axis. Optional: draw some landmarks on the Data Sheet to help you and your students find the plot again.

(3') Bed of Woodchips



(6')

4. Have students cover leaf piles with another 8 centimeter (3 inch) layer of woodchips.

5. When back in the classroom have students complete their own Data Sheets in their Leaf Field Guide based on the information from the teacher's Data Sheet. If desired, have students color the Data Sheets. Ask students to predict which leaves will decay the fastest.

6. Bring students back to the site once per month to uncover leaf piles and observe the progression of decay when compared with leaf identification guides. Students should be able to use their Data Sheets to locate the patch and to determine what species of leaf is in each line. With a small trowel or with their hands, students should carefully remove the top three or four inches of woodchips from the pile. If you choose, have your students only remove part of the woodchips to view some of the leaves.

7. At each monthly visit, have students rate the extent of decomposition of the leaf species. The students should use a scale of one to five, one being the most decayed and five being the least decayed.

8. The students should also make note of the decomposer organisms in the mulch pile. The results of each monthly outing should be recorded on the Leaf Monitoring Sheet.

CONCLUSION

1. By the end of the school year, your students should have a good idea of how long it takes some kinds of leaves to decompose. Discuss the class' results by asking the following kinds of questions. Different species' leaves decay at varying rates (oaks take the longest and dogwoods the least time). Which leaves decayed the fastest? The slowest? How does this compare to the students' predictions?

2. Based on the findings of your class, in which season did the most decomposition occur?

3. Discuss animal decomposers found in the mulch pile. What is their contribution to the decomposition process?

4. The leaves that are the slowest to decay take more energy to produce and are also the most resistant to "predation" by herbivores, mostly insects. From a tree's perspective, why might having tough leaves be a good thing?

JOURNAL QUESTIONS

If I were a tree, what kind of leaves would I have?
Make a list of the things fallen leaves are used for in Nature.
What are some things I can do to make less litter?
Draw a picture of some of the animals that live in the decomposition pile.

EXTENSIONS

1. **Talkin' Trash**. Discuss landfills and try composting a balloon or other non-food garbage. Ask students how long they think it will take for different items such as a tissue, glass bottle, apple core etc. to decompose.

2. **Try Something Different**. Try different treatments on your mulch pile: hot water, salt or leaves torn into small pieces. Use springtime leaves (new) instead of fallen autumn leaves in the experiment.

3. **Don't Get Defensive.** Discuss the various chemical (bitter taste or poisons) and physical (thorns, protection from insects)defenses that some plants have.

4. **Litter Did We Know...** Litter is a reality; man-made products rarely decay. Should we buy products based on how long they will last? How about based on a product's ability to be reused or recycled?

5. **Keys And Tell.** Use the different species of leaves to make a simple dichotomous key.

6. **It's A Control Thing.** Demonstrate the use of a control in science by conducting this experiment indoors inside a dishpan. The absence of water and weathering should make a big difference.

REFERENCES/ADDITIONAL READING

Appelhof, Mary. 1982. Worms Eat My Garbage: How to Set Up and Maintain a Worm Composting System. Flower Press. Kalamazoo, MI. 100 pp. (TLCPL)

Appelhof, Mary, Mary F. Fenton and Barbara L. Harris. 1993. Worms Eat Our Garbage: Classroom Activities for a Better Environment. Flower Press. Kalamazoo, MI. 214 pp. (TLCPL)

Brockman, C. Frank. 1986. Trees of North America. Golden Press. New York, NY. 280 pp. (TLCPL)

Rodale, J. I., Ed. 1971. The Complete Book of Composting. Rodale Books, Inc. Emmanus, PA. 1007 pp. (TLCPL)

CHILDREN'S LITERATURE/ TRADE BOOKS

Lyon, Geroge, E. Tom Parker, Illustrator. 1989. A B Cedar: An Alphabet of Trees. Orchard Books. New York, NY. (TLCPL)
An alphabet book introducing leaves from a variety of trees.

Oppenheim, Joanne. Jean and Mou-sein Tseng, Illustrators. 1995. Have You Seen Trees? Scholastic. New York, NY. (TLCPL)
Rhythmic poem that celebrates trees of each season.

Parnall, Peter. 1990. Woodpile. Macmillan Company. New York, NY. (TLCPL)
What lives in the cracks and crannies of the woodpile? And where did the wood come from? A woodpile is full of stories.

Sohi, Morteza E. 1993. Look What I Did With a Leaf. Walker and Company. New York, NY. (TLCPL)
Provides examples of different kinds of animals that can be made out of leaves.

Data Sheet

Rate of Decomposition of Leaf Species

Name _____ Date _____

1. Imagine that the oval represents your decomposition plot. Draw each pile of leaves.

2. Write the name of each kind of leaf on the corresponding line.

_____

_____

_____

_____

_____

Data Sheet

Leaf Monitoring Sheet

Rate of Decomposition of Leaf Species

Write the date in the first column. Write the name of the most decayed leaf under number 1, the next most decayed under number 2, and so on.

Date	Most Decayed 1	2	3	4	Least Decayed 5

Water

- Weather Station
- Snow - How It Changes Life For Animals

Weather Station
Whether We Like It Or Not

GRADE LEVEL/TOPIC: 2-3/Water

TIME REQUIRED/RECOMMENDED SEASON: 180 minutes for instrument construction, 45 minutes per day for 5 days for monitoring / Any season.

SCIENCE SKILLS: Observing, Data Collecting and Recording, Record Keeping, Monitoring, Measuring, Tool Making and Use

KEY WORDS: Precipitation (Rain, Snow, Sleet, Hail), Weather, Water Cycle, Condensation, Rain Gauge, Anemometer, Weather Vane, Thermometer

OVERVIEW

Your students will make instruments to monitor the weather relative to your school's location. The introduction will take approximately 30 minutes of classroom time, and the construction of each instrument, approximately 30 to 60 minutes. Daily monitoring will involve an additional 15 - 30 minutes. In-class weather reports, or skits, will involve approximately 15 minutes. This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.

PURPOSE

1. Students will construct simple measuring devices and use them to monitor precipitation, wind speed and direction, and temperature over time.

2. Students will describe the water cycle and the effect of temperature on air and will explain that these two factors contribute to the weather we all experience.

MATERIALS

For The Class
- Rain Gauge Instruction Sheet
- Weather Vane Instruction Sheet
- Anemometer Instruction Sheet
- Weather Station Data Sheet master
- Large sheet of newsprint for class Data Sheet
- Stopwatch for measuring wind speed
- Thermometers
- Class-made weather instruments
- Optional for demonstration:
  - Hot plate
  - Copy of Coil Template

For Each Student
- Zip-locked bag, half-filled with water
- Materials for weather instruments (See Instruction Sheets.)
- Weather Station Data Sheet
- Clipboard with pencil

Prepwork

Prepare the materials for the construction of the weather instruments as outlined in the Prepwork sections of the Instruction Sheets. Fill zip locked bags half-full of water until there are enough for one per student. If using the optional demonstration, cut the copy of the Coil Template into a coiled "snake", as illustrated. Photocopy one copy of the Weather Station Data Sheet for each of your students. Prepare the large sheet of newsprint as a class Data Sheet for display in the classroom. Include a column where the students can summarize the day's weather based on their observations. Gather all other necessary materials.

BACKGROUND INFORMATION

Weather is the condition of Earth's lower atmosphere (from the clouds down to the Earth's surface) at any given time and place. Weather changes daily. It is created by the interaction of our nearest star, the Sun, and the Earth. Local weather conditions are described by relative variables such as temperature, moisture, wind speed and barometric pressure.

An important aspect of weather is water in all of its varying forms and interactions with our planet. These interactions are collectively known as the water cycle. The amount of water on Earth is fixed. The water present today is the same amount as was present when dinosaurs walked the Earth and when Columbus happened upon the new world. Water's ability to change its form from solid to liquid to gas within a narrow temperature range gives it the ability to significantly influence our environment. The **water cycle** is simply a model which demonstrates how the liquid water of our oceans and lakes, rivers and streams evaporates into the air and is represented, in vapor form, by humidity. Water vapor also comes from plants (transpiration), ice (sublimation), and extreme heat (steam from boiled water). When conditions are right, water is released from the atmosphere in its liquid form as **precipitation (rain, snow, sleet or hail).**

Condensation occurs when air of one temperature overlays land or air with a much higher or lower temperature. This allows water vapor to condense, or become liquid, in the form of dew, frost, clouds, fog and one's breath on a cold winter day.

The weather affects our daily lives in many ways. It can enhance or ruin a family picnic. It can make travel difficult. It can allow crops to grow or to die due to the amount of rain received. Weather dictates the way we dress when outdoors. These reasons and many more are why people are so interested in forecasting (predicting) tomorrow's weather. One of the easiest ways to predict the weather is to gather as much information as possible about the weather as it occurs, record it and use that data as an indicator of what may be coming the next time similar conditions are present.

Common tools or instruments used in measuring and recording the weather are **rain gauges** (precipitation), **anemometers** (wind speed), **weather vanes** (wind direction) and **thermometers** (temperature). Three of these instruments will be made by your class so that you and your students will be able to monitor the weather and observe how it affects life in the land lab.

BEFORE YOU GO

1. Review weather and the water cycle with your students as outlined in the background information. Demonstrate the water cycle by having each student set a zip locked bag, half-filled with water, in direct sunlight. Discuss the process which brought droplets of water to the top of the baggie. If desired, demonstrate the effects of surface heat on air by suspending the coiled paper "snake" that you prepared 1 meter (3 feet) above a hot plate. What happens to the "snake"?

2. Explain to your students that the weather that you will be measuring with your class-made instruments is caused by the water cycle and the heating and cooling of the atmosphere. Instruct your students to each make one weather vane, one anemometer and one rain gauge as outlined in the corresponding Instruction Sheets. Discuss how they are used and what they can tell us.

3. Choose one example of each instrument to be your class' representative. Always use these designated examples when monitoring the weather. All other examples can be taken home by their creators and used to monitor weather in the students' backyards. The rain gauge should be set out 24 hours prior to monitoring, if possible.

4. Have your students cut out and bring in daily weather maps from newspapers on each day that you will be monitoring the weather, Monday through Friday.

5. Distribute Weather Station Data Sheets and clipboards with pencils to the students. Take the representative weather instruments, stopwatch and thermometers with you when you go outside.

PROCEDURE

1. Set up your weather-monitoring instruments on a predesignated area of the Land Lab's fence. Take initial (first time) readings from each instrument and have the students record their findings on the Data Sheets. Be sure to have them record the date and the time of day and include any observations that they have regarding the day. They should describe the current weather conditions, cloud cover, visibility and even any wildlife observed in the area (crickets chirping, birds flying or not flying, etc.)

2. Distribute the thermometers, and have your students take the temperatures of different surfaces while your class is recording data from your weather station. Encourage them to record the temperature of the air, the ground, the soil 5 centimeters (2 inches) beneath the surface, the parking lot, a puddle of water and anything else they see. Record this information also for later discussion.

3. Return to the Land Lab to make your measurements each day for at least one week. Try to check your weather station at about the same time each day.

CONCLUSION

1. After each monitoring trip, you and your class may want to transfer your daily observations from the Data Sheets to the large class Data Sheet on display. Discuss your findings. Let the students summarize the day's weather in the column provided.

2. Allow your students to compare their findings with the daily forecasts which they clipped from the newspaper. How accurate were the forecasters in predicting the weather that they observed?

3. As a culminating Activity, have your class act out daily weather reports based on their findings. A sample script of a weather report is provided.

• • Weather Report Script • •

SCENE: Set up a weather newsroom. You will need one large desk or table, five chairs and a microphone made of paper or whatever your creativity allows. Each day you will need to assign a different student to report on temperature, wind speed, wind direction and precipitation. You will also have to assign a news anchor.

ANCHOR: "Good morning class and good morning [Mrs. Smith]! The date is _____ . The time is___:___ A.M. This morning, the weather report is brought to you by [The Little Red Elementary School]. Reporting the weather today is [Student's Name] with the temperature, [Student's Name] with the wind speed, [Student's Name] with the wind direction and [Student's Name] with precipitation. My name is [Student's Name], your weather news anchor. Let's begin with temperature."

TEMPERATURE: "Thank you, [Student's Name]. As of A.M., the air temperature outside [The Little Red Elementary School] is ____°F or ____°C. The air temperature inside [Mrs. Smith's] classroom is currently____°F. (Add any other temperatures recorded that day.) That's all for today's temperature. Now for the wind speed."

WIND SPEED: "Thank you, [Student's Name]. This morning at ____ A.M., the wind speed was ____ miles per hour (mph). This reading was taken in the open field just east of our Land Lab. Today's wind speed is (higher/lower/the same) as the forecast in this morning's newspaper. More to come later. Now for today's wind direction."

WIND DIRECTION: "Thank you, [Student's Name]. This morning we have variable westerly winds. (This means that the wind is mostly coming from the West but it changes for brief periods of time.) Wind direction was observed this morning with our weather vane for 20 minutes. Now for precipitation."

PRECIPITATION: "Thank you, [Student's Name]. In the last 24 hours, we have had ____inches (cm) of precipitation in the form of_____ . Currently it is (describe, in detail, any precipitation which is occurring at the moment and include intensity, visibility and any other hazards or advice you may observe or have). Now, back to our weather news anchor."

ANCHOR: "Thank you for that detailed, up-to-the-minute report on the weather as it is happening around us. Tune in tomorrow for another look at the weather. Have a nice day."

JOURNAL QUESTIONS

Record class' findings in your journal.
Write a paragraph about why people listen to forecasts, and include how the weather caused your to change your plans for a day's activity.
Describe your favorite and your least favorite types of weather.

EXTENSIONS

1. **TV Weather**. Have your students watch the TV weather forecast on the night or morning before they monitor the weather and compare these predictions with their findings. If their schedules permit, meteorologists from Channels 11, 13 and 24 will come to your classroom and explain how they predict the weather and what instruments they use. (Call the stations, and leave a message or ask to speak to the meteorologists directly.)

2. **Graphing**. Have your students graph one or more of the weather variables measured (temperature, wind speed, precipitation) over the monitoring period. Are they able to recognize any patterns in these variables over the course of the week?

3. **Reverse Reporting.** Give your students a specific type of weather-related event such as a snow day, a tornado or a class picnic, and have them write a weather report that could have been given on the day before the event. Allow them to share their reports with their classmates.

4. **It's Raining Cats And Dogs**. Have your students brainstorm a list of common phrases and folklore associated with the weather. Research the origin of some of these sayings with your class.

5. **Weather Lingo.** Familiarize your class with some of the symbols found on a weather map (fronts, isobars, highs/lows, etc.). Draw their attention to times of sunrise and sunset and phases of the moon. Hang a large, laminated map of the United States on the wall, and have the students draw in some of the symbols used for that day by weather forecasters. What symbols are typically used when severe weather occurs?

REFERENCES/ADDITIONAL READING:

Eichenlaub, Val L. 1979. Weather and Climate of the Great Lakes Region. University of Notre Dame Press. U.S.A. 335 pp. (TLCPL)

Lehr, Paul E., R. Will Burnett and Henry S. Zim. 1975. Weather. Golden Press. New York, NY. 160 pp. (TLCPL)

Mandell, Muriel. 1990. Simple Weather Experiments With Every Day Materials. Sterling Publishing Company, Inc. New York, NY. pp. 104-107, 119. (TLCPL)

CHILDREN'S SCIENCE/TRADE BOOKS

Branley, Franklyn M., author. Harriett Barton, illustrator. 1983. Rain and Hail. Thomas Crowell. New York, NY. (TLCPL)
Describes evaporation, formation of clouds and different kinds of precipitation.

dePaola, Tomie. 1975. The Cloud Book. Holiday House. New York, NY. (TLCPL)
A lively presentation of information and stories about clouds, including common cloud types, their shapes and how clouds can tell us about changes in the weather.

DeWitt, Lynda, author. Carol Croll, illustrator. 1991. What Will the Weather Be? Harper Collins. New York, NY. (TLCPL)
Explains temperature, humidity, wind speed and direction and discusses how meteorologists gather information for their forecasts.

Dorros, Arthur. 1989. Feel the Wind. Let's-Read-And-Find-Out Science Series. Thomas Crowell. New York, NY. (TLCPL)
Introduces familiar results that demonstrate the characteristics of wind and describes the causes and uses of wind.

Gibbons, Gail. 1990. Weather Words and What They Mean. Holiday House. New York, NY. (TLCPL)
Introduces basic weather terms and concepts, including temperature, air pressure, moisture and wind.

Graber, Mark, author. Jack Graber, illustrator. 1994. A Raindrop's Journey. Creative Advantage. (TLCPL)
The adventures of a single raindrop. Explains importance of water and the water cycle.

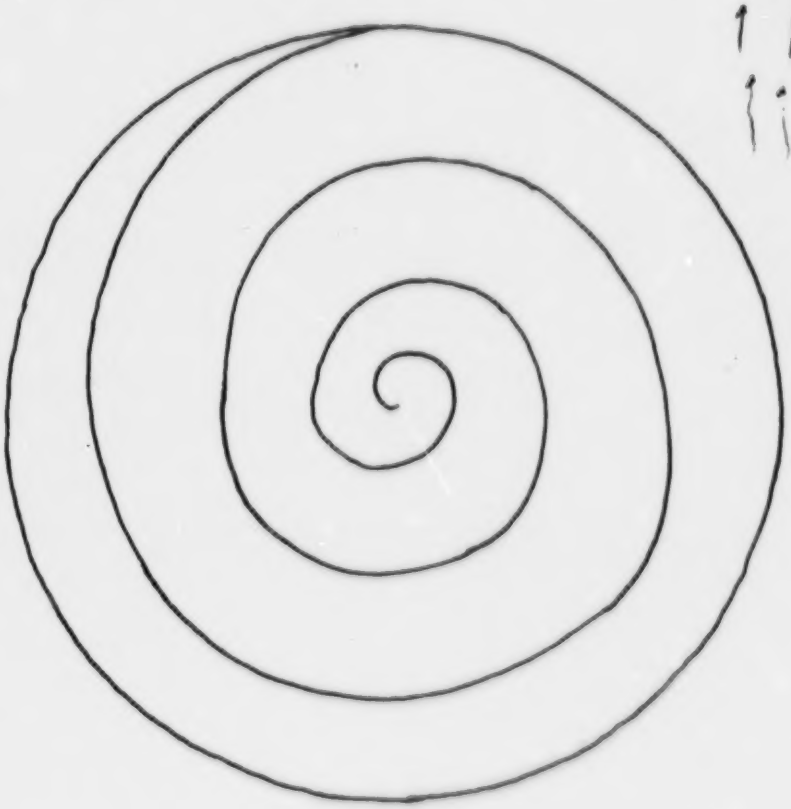
McKissack, Patricia C., author. Jerry Pinkney, illustrator. 1988. Mirandy and Brother Wind. Alfred Knopf. New York, NY. (TLCPL) *To win first prize in the Junior Cakewalk, Mirandy tries to capture Brother Wind for her partner.*

Prelutsky, Jack, author. Marylin Hafner, illustrator. 1980. Rainy, Rainy Saturday. Greenwillow Books. New York, NY. (TLCPL)
In 14 delightful poems, children's views of the fun, boredom and disappointment caused by rainy Saturdays are presented in rhythmic, thoughtful verses.

Wolff, Barbara. 1976. Evening Grey, Morning Red: A Ready-to-Read Handbook of Weather Wisdom. Macmillan Publishing Company, Inc. New York, NY. (TLCPL)
A handbook of weather forecasting based on rhymes, sayings and signs used in America for centuries.

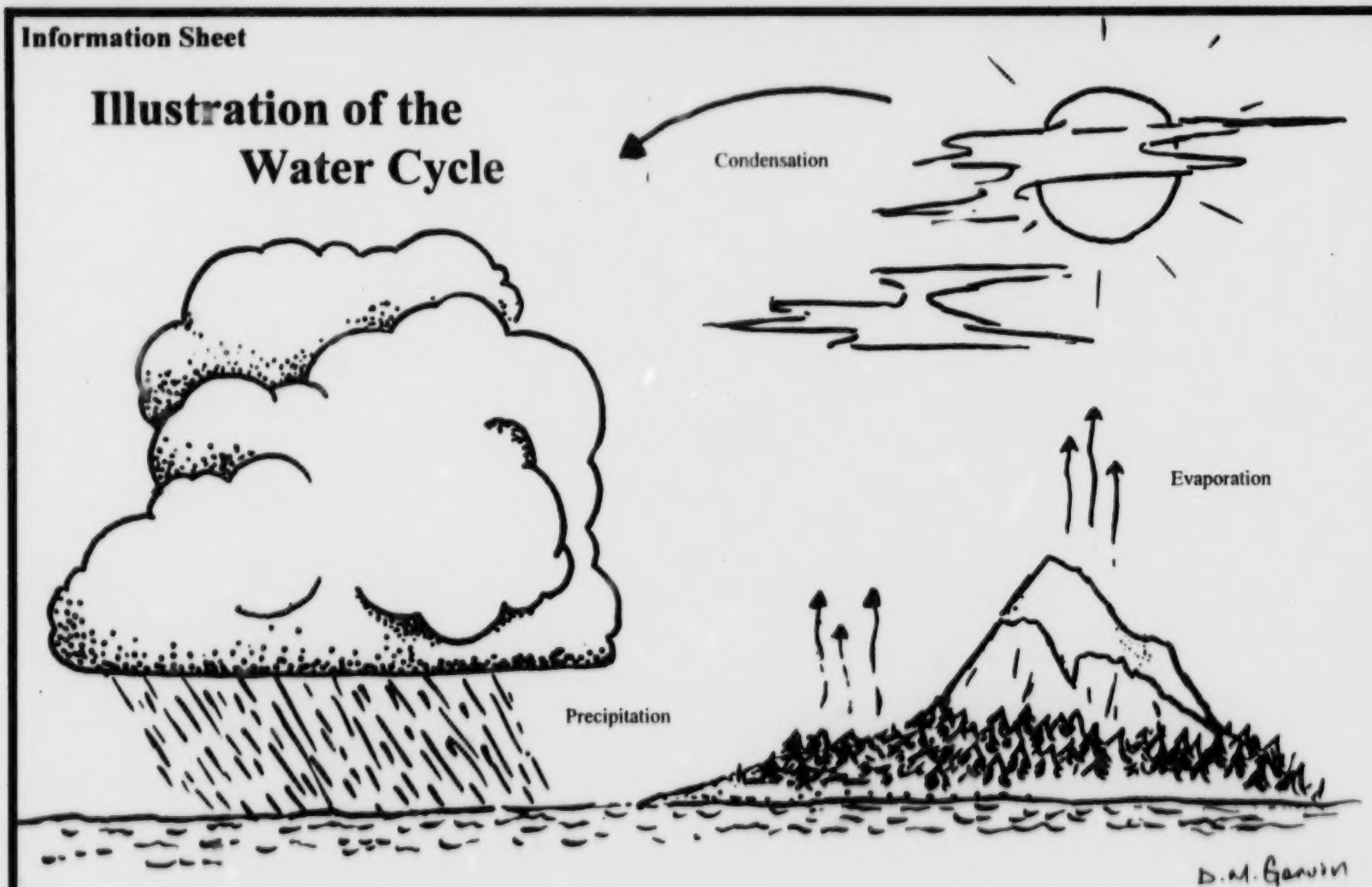
Zolotow, Charlotte, author. Margaret Bloy Graham, illustrator. 1952. The Storm Book. Harper Trophy. New York, NY. (TLCPL)
A summer storm sweeps over countryside, city and seashore.

Weather Station: Coil Template



Information Sheet

Illustration of the Water Cycle



Instruction Sheet

RAIN GAUGE INSTRUCTION SHEET

What You Need

For Each Student

- Open container
  For example: Coffee can, peanut butter jar, 2 liter bottle with neck and spout removed
- Masking tape
- Pencil
- Ruler

Making Your Rain Gauge

1. With a pencil and a ruler, mark inches and centimeters along the length of the masking tape: inches on the left side, centimeters on the right side. We recommend using a pencil because it doesn't "run" when wet.

2. Attach the length of tape vertically to side of the open container.

Using Your Rain Gauge

1. Place three containers on fence posts or on level ground in your Land Lab. Be sure that your students place the rain gauges in an open location, well away from trees or buildings. It is important that you use three rain gauges of different shapes and sizes to determine the average rainfall.

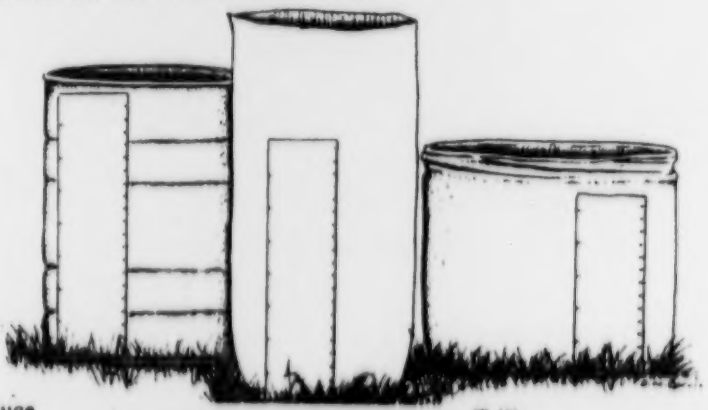
2. After each rain, measure the amount of rain water in each of the containers and record the information (inches/centimeters), along with the date and time on your Data Sheets. The amount should be the same in each of your rain gauges. If they are different, have your students get the average by adding up all three readings and dividing by 3. (They will probably need help with this.)

3. After you have recorded your data, empty the rain water from each of the rain gauges and place them in the same locations that they were in before.

4. In the event of snow, use the same procedure. Encourage your students to take care that the snow is not touched with their hands; if it melts, your reading will not be as accurate!

5. Compare your findings with the amounts announced on the radio or TV. They will not always agree. The amount of rainfall can be different from one side of the street to the next.

Source: Mandell, 1990.



Weather Station Rain Gauge

Instruction Sheet

WEATHER VANE INSTRUCTION SHEET

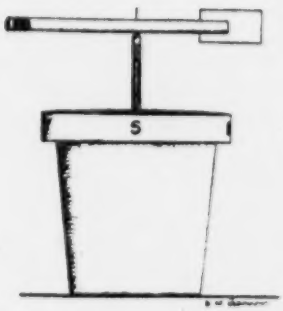
What You Need

For The Class

- Magnetic compass
- Safety razor or exacto knife for teacher's use only

For Each Student

- Drinking straw
- Pencil with eraser
- Flower pot or soup can, new or used
- Strip of red construction paper (1 cm X .5 cm/0.5" X 1")
- One-fourth of 3" X 5" index card
- Scissors
- Hat or "T" pin
- Glue
- Permanent black marker



Prepwork

Before your class begins this project, the teacher must prepare one straw per student in advance: With a safety razor or exacto knife, make a 2.5-cm (1-inch) vertical slit in one end of each student's straw. (See illustration.) Cut 3" X 5" index cards into fourths until there are enough quarters (1.5" X 2.5") for one per student.

Making Your Weather Vane

1. Pass out all materials to your students.

2. Insert the index card quarters into the slits in the straws and glue them in place. The card will act as the "tail" of the weather vane's arrow.

3. Wrap the red piece of construction paper around the end of the straw opposite the tail. Glue the red paper in place. This will act as a direction indicator, or point, for the weather vane.

4. Insert the hat pin into the straw 5 centimeters (2 inches) from the tail.

5. Push the pin firmly into the eraser located at the top of the pencil. The straw with tail and red pointer should now be secured perpendicular to the pencil.

6. With the permanent black marker, draw four black "marks" on the lip of the flower pot, dividing it into fourths, or quarters. (It may help if you have the students orient their pots to the face of a clock, making marks at 12:00, 3:00, 6:00 and 9:00.) Instruct your students to try to center these marks as well as possible. These marks will represent North, South, East and West.

7. Instruct your students to write "N", "S", "E" and "W" on the sides of the flower pot below the marks. "N" should correspond with 12:00, "S" with 6:00, "E" with 3:00 and "W" with 9:00. Your students may need some help with this.

8. Fill the flower pots with earth, wood chips, stone or clay. Set the pencil vertically in the pot, burying it into the material with which the pot is filled. Make sure the pencil is secure enough to stand vertically erect.

Continued...

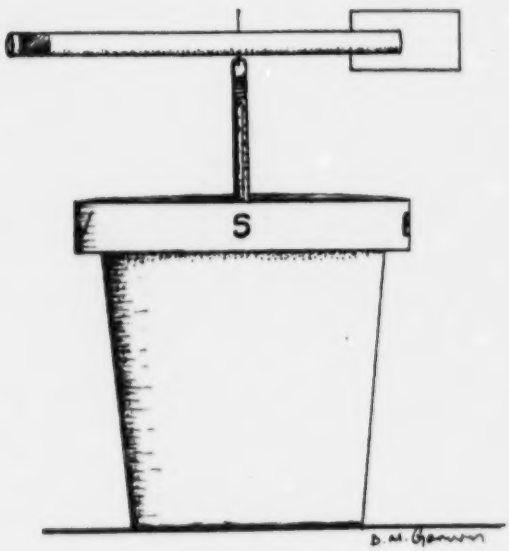
Using Your Weather Vane

1. Put your weather vane in an open space where the wind will not be stopped or influenced by buildings or trees. Use a compass to orient the pot so that the "N" is facing North; the "N" on the flower pot will line up with the North end of the magnetic needle on the compass.

2. As the wind blows, the weather vane moves indicating the wind direction. Wind direction is the direction from which the wind is blowing. It is important that you and your class use the same weather vane when monitoring the weather.

NOTE: In the United States and all places north of the equator, a wind that shifts in a counter-clockwise direction brings a Low Pressure System (stormy weather). East winds usually bring rain. North winds bring colder weather. South winds bring warmer temperatures.

Source: Mandell, 1990.



Instruction Sheet

ANEMOMETER INSTRUCTION SHEET

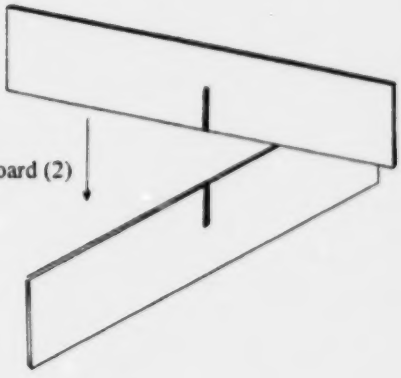
What You Need

For The Class

- Drill with 1/4" bit
- Utility knife
- Stopwatch or watch with sweep second hand

For Each Student

- 5 cm X 46 cm (2" X 18") pieces of corrugated cardboard (2)
- Scissors
- Glue
- Styrofoam cups (4)
- Permanent red marker
- Long, thin nail
- Hat pin with large head (6 cm/2.5")
- Unsharpened pencil with eraser
- Block of wood



Prepwork

You will have to prepare the base for the anemometer in advance. The base can be made of a piece of wood greater than 2.5 cm (1") thick. (A 30-centimeter (12-inch) length of 2" X 4" will work nicely.) With an electric drill and a 1/4" bit, drill a hole into the center of each base. Be careful not to drill entirely through the piece of wood! With the utility knife, cut corrugated cardboard into 5 cm X 46 cm (2" X 18") pieces until there are enough for two per student.

Making Your Anemometer

1. In the center of each piece of cardboard, make a cut (slit) fully one half its width.

2. Color the exterior of one styrofoam cup red with the permanent marker. Do not color the bottom of the cup.

3. Glue one cup to each end of the two pieces of cardboard.
NOTE: YOU MAY WANT TO HAVE YOUR STUDENTS ONLY GLUE TWO CUPS, ONE PER CARDBOARD PIECE, AT A TIME TO ALLOW THE GLUE TO DRY.

4. After one cup is firmly glued to each cardboard piece, turn the cardboard over and glue the second cup to the other end. Allow the glue to dry.
NOTE: THE LOCATION OF THE RED CUP IS UNIMPORTANT.

5. Join the two pieces of cardboard, with cups attached, so that they make a cross by inserting one slit into the other. Be sure that all of the cups face in the same direction.

6. With a long, thin nail, make a hole in the center of the "cross" where the two pieces of cardboard are held together.

7. To create the base of the anemometer, glue the unsharpened end of a pencil into the pre-drilled hole. Brace it so that it dries vertically erect. Allow it to dry overnight.

8. Attach the cross, with cups attached, to the base by placing the hat pin into the hole where the two pieces of cardboard intersect and pushing it firmly into the eraser of the pencil. Your cup anemometer should spin freely; if not, enlarge the hole at the cross.

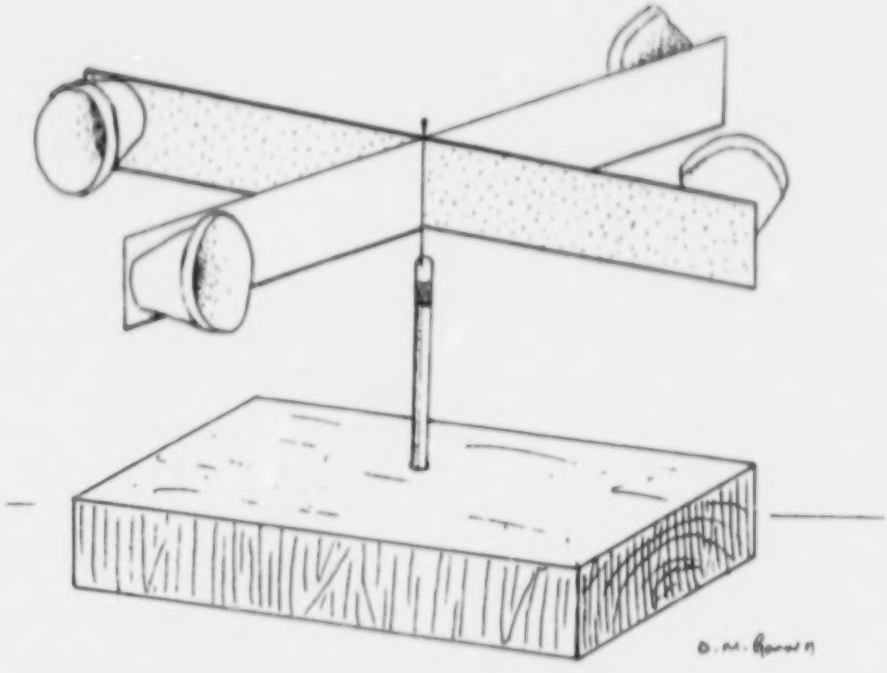
Continued...

Using Your Anemometer

1. Take your anemometer outdoors. Be sure to place it in the open and at least 1 meter (3 feet) above the ground.

2. To measure the wind's speed (velocity), have students count the number of times the red cup passes by in one minute. (Use a stopwatch for this.) The more revolutions per minute, the greater the wind speed. A rapid increase in wind velocity can mean rain and/or thunderstorms are coming soon.

Source: Mandell, 1990.



Data Sheet

Weather Station

Name _____

Date	Mon.	Tues.	Wed.	Thurs.	Fri.
Time					
Weather Conditions					
Cloud Cover and Visibility					
Rainfall/Snowfall (inches)					
Rainfall/Snowfall (inches)					
Wind Speed (revolutions per minute)					
Wind Directions					
Air Temperature °F					
Other Temperatures °F _____ _____ _____	 _____ _____ _____	 _____ _____ _____	 _____ _____ _____	 _____ _____ _____	 _____ _____ _____
Wildlife Observed					

Snow - How It Changes Life For Animals

Snow - What If I'm Up To My Tail In Snow?

GRADE LEVEL/TOPIC: 2-3/Water

TIME REQUIRED/SEASON: 90 minutes including one day between the first and second parts of this Activity /Winter. (New snow is best for this Activity.)

SCIENCE SKILLS: Observing, Measuring, Comparing, Collecting and Recording Data, Predicting, Graphing

KEY WORDS: Snow, Density, Temperature, Sign, Depth

OVERVIEW

In this Activity, students will be exploring characteristics of snow and how they affect the behavior of animals. Before this Activity, your class will build a snowpile (30 minutes). Students will be looking for animal sign (15-20 minutes), taking **temperature** readings in and around the snowpile (20-30 minutes), and getting samples of snow to explore snow density (10 minutes). Feel free to break this Activity into smaller lessons. If this is your first Activity, please consult the Introduction.

PURPOSE

1. Students will describe ways that snow changes the environment and behavior of animals.

2. Students will describe and measure characteristics of snow that can influence animal behavior.

MATERIALS

For The Class
- Snow shovel
- 5-gallon buckets or large containers (5-10)
- Masking tape
- Permanent marker
- Glass of water (optional)

For Each Group Of 3-4 Students
- Meter stick, or a yard stick with metric equivalents drawn on it
- Clipboard and pencil
- Thermometer
- Animal Sign Census Bingo Board

For Each Student
- Data Sheets 1 and 2
- Pair of similarly-sized, clear containers (see Prepwork, below)

Prepwork

About a week before this Activity, procure pairs of containers which your students can fill with snow to compare density. It will be easier for your students to compare the two containers if they are the same size. If you have trouble procuring a pair for everyone, have a pair per small group or pair of students, or use one pair as a demonstration. Small, clear plastic party glasses, 16 or 20 ounce plastic pop bottles with the tops cut off or baby food jars (if you don't mind working with glass) are some possibilities. If desired, calibrate the containers by pouring a known quantity of water (in 25 ml increments, for example) and mark the water level with an permanent marker.

At least one day before this Activity, use shovels and buckets to build a snow pile near the Land Lab for temperature readings. The pile should be about one meter (three feet) high and one to two meters (three to six feet) wide for several groups to take temperature readings at once. Try not to pack snow with hands or shovels. New snow works best.

Photocopy one copy each of Data Sheet 1 and Data Sheet 2, and one "Animal Census Bingo Board" for each student.

BACKGROUND INFORMATION

What we think of snow often depends on what we have to do that day. For the child hoping for a snow day, lots of snow means freedom and fun. For an adult that has to go to work, that same snow creates problems and can be anything but fun. Slippery roads make completing daily tasks hazardous. Varying **temperatures** can coat everything with ice, causing delays and power outages. In some cases, snow can produce a life-or-death situation.

For some groups of humans adapted to living in very cold climates, snow is a way of life. These cultures take advantage of the fact that the air spaces between snowflakes can act as insulators in building structures such as igloos.

Snow also creates a challenge for animals. It can be a help or a hindrance, depending on the animal and the conditions. For small, burrowing animals such as mice, voles and shrews, snow creates a safe haven. Theses animals dig tunnels in the snow, reaping the benefits of snow's insulative properties. They can also avoid detection by predators. Medium-sized animals such as rabbits can walk on top of dense snow, thereby exploiting new food resources. Animals walking on top of snow leave behind footprints that can lead a predator to a meal. Some of these tracks may be visible to your students.

For predatory animals such as foxes, snow can create a difficult situation. As mentioned above, many prey animals hide in the snow. Furthermore, if the snow is loose and fluffy, medium and large animals must plow through it instead of walking on top of it. We call tracks, scat (droppings) and other clues of their presence animals leave behind **sign**.

The cold temperatures associated with snow can freeze water sources, rendering them unavailable to animals. This coupled with scarce food resources can take a toll on animal numbers. Of course, some animals avoid winter altogether by hibernating or migrating. This Activity, therefore, deals mainly with birds and mammals - warm-blooded creatures.

Snow as an environment has several measurable characteristics about it. Temperature and **density** can be assessed by your students to help them understand how winter affects some common animals. For example, the density of snow increases the longer it stays on the ground and the deeper it piles up. For small mammals such as mice, voles and shrews, fluffy, new snow, which is of low density, is best for digging tunnels and staying warm. For animals like fox, raccoons, opossum, deer, and skunks, snow that has a high density has been around for a few days and is easier to walk on.

Differences in temperature between the air and underneath the snow are small but measurable. We expect the temperature underneath the snow to be greater than that of the air. Furthermore we expect the temperature will be greater when taken at head or shoulder level, than the temperature at boot level.

Your students can compare the density of two samples of snow by filling similarly sized containers with different kinds of snow. The samples will be brought inside and the resulting amounts of water compared. Because of those insulating air spaces, the density of snow will always be less than that of water. Furthermore, higher density snow leaves more water than low density snow. If you fill up a container with one cup of new snow, it will melt into about 1/10 of a cup of water. Old snow will yield more water.

This Activity should be done when the air temperature is less and 0 degrees Celsius (32 degrees Fahrenheit).

BEFORE YOU GO

1. Discuss with your class animals that are active in the winter. See Background Information for specific examples. Discuss these common animals' strategies for dealing with winter and how winter makes life more difficult in terms of food-getting, shelter and lack of liquid water.

2. Animals that are active in the winter leave what is called sign. Sign can consist of something physical, like scat (droppings) or an impression like a track. Review animal signs by looking at the Animal Sign Census Bingo Board (from the Activity of the same name).

3. Discuss the concept of snow density in terms of its effect on animals (see Background Information). Snow that has a high density can support the weight of an animal. In other words, it is hard-packed, and more snow can fit in small space. Tell students they will be comparing high and low density snow by bringing samples of snow inside and letting them melt.

4. Make sure the students know how to read a thermometer. They can take readings in either degrees Fahrenheit (F) or degrees Celsius (C). If desired, go through the conversion from F to C. Students can measure the

BEST COPY AVAILABLE

temperature of the air and in a glass of cold water in the classroom. Caution the students not to bump the glass bulb of the thermometer on anything, or it may break. They should also practice using the meter stick by measuring the height of various objects such as themselves or desks/chairs. You can use centimeters as the unit of measurement.

5. Use the masking tape to attach the thermometer to the "0" end of the meter stick. Attach such that the backing of the thermometer is flush with the meter stick.

6. Divide the class into small groups, and take materials and class outside.

PROCEDURE

1. Instruct each small group of students to use the Bingo Board as a reference and look around the Land Lab for animal sign. Assign one person to fill in Data Sheet 1 for the group.

2. Have each group of students take temperature and height readings of the following. Assign one person in each group to record the data on Data Sheet 2.

(a.) Temperature and height at shoulder level (hold thermometer straight out)

(b.) Temperature of the snow at ground level (height = 0)

(c.) Temperature at the top of the snowpile (hold so bulb of thermometer is just above the snow.)

(d.) Temperature of the ground at the bottom of the snowpile. Use shovel to make several (one per group) narrow shafts from the top of the pile to the ground. Put thermometer through the shaft and rest it on the ground while students count to 60. Pull out and read. Put back in to measure height of snowpile.

3. Distribute the pairs of containers for comparing the density of snow. Have students fill one of the containers by scooping the container along the ground to just fill it with snow. Do not pack. Have students pack as much snow as they can into the other container by filling it and tamping the snow down with their hand.

CONCLUSION

1. Once inside ask children what will happen to the snow samples now that they are inside. Ask students to predict how much water will be left when the snow has melted. Will the containers be full? Half full? Just a little bit of water? (The low density snow will result in about 1/10 as much water. The high density snow will result in about 1/2 as much water.)

2. Have each group review the kinds of animal sign seen by distributing Data Sheet 1 to all students and having them copy it. Ask them to speculate on how the sign was made and where that animal could be now.

3. Have each group review its temperature readings by distributing Data Sheet 2 and having them copy it. Make headings on the board for each group to display its readings. Display each group's temperature readings on the board.

4. Choose one set of data for the class to graph, or have each group graph their own data. Which temperature was the highest? (on the bottom of the snow pile) Which temperature was the lowest? (on the ground) What does this mean for animals? (The warmer temperatures mean that small animals such as mice can stay warmer if they stay under the snow.) Based on the temperature readings, ask your students, "If you were a mouse, where of the four places you took temperature readings would you want to spend the night?"

5. Ask children if they put more snow into one of the containers compared to the other. That container represents high density snow, the kind that animals can walk on. After the snow has turned into water (this time can also be used for a discussion of the phases of matter, solid-liquid-gas) have students compare the two containers. Which container has more water? How does high density snow help some kind of animals? (It makes walking around easier. Snow of low density does not support the weight of an animal and it has to plow through to get around.) On the other hand, low density snow is good for tunneling animals.

6. If desired, have students graph the relationship between height and temperature. Use the two readings from the snowpile or the two from the ground.

JOURNAL QUESTIONS

Imagine you are one of the following: pheasant, vole, deer, fox, sparrow, mouse, shrew, cat. Write a story about how you change your daily activities (getting food, finding a place to live) because of snow.
Draw a winter scene with any of these animals.

EXTENSIONS

1. **What a Flake.** Look at snowflakes on dark cloth or pieces of construction paper. For best results, put the cloth or paper in the freezer for 20 minutes. Or, bring the cloth with you as you and your class play outside for a while!

JOURNAL QUESTIONS

Imagine you are one of the following: pheasant, vole, deer, fox, sparrow, mouse, shrew, cat. Write a story about how you change your daily activities (getting food, finding a place to live) because of snow.
Draw a winter scene with any of these animals.

EXTENSIONS

1. **What a Flake.** Look at snowflakes on dark cloth or pieces of construction paper. For best results, put the cloth or paper in the freezer for 20 minutes. Or, bring the cloth with you as you and your class play outside for a while!

2. **A Snowflake by Any Other Name...** The Eskimo people, or Inuit had an extensive vocabulary to describe the snow in their environment. Research these terms and apply them to the different kinds of snow in your Land Lab.

3. **A More In-Depth Study.** Monitor snow pile over several days or weeks and take temperature and density measurements.

4. **Explore Snowpiles in Your School's Parking Lot.**

5. **A Long, Long Time Ago...** Discuss glaciers and climate changes.

6. **Now That's Cold-Blooded**. Where are the animals that cannot regulate their body temperature, such as insects, frogs, turtles and snakes? Do all birds stay here in the winter or do some leave?

7. **Way cool.** Catching snowflakes on microscope slides to examine under a microscope is an Activity that does not work all the time, but when it does, it is spectacular. Keep a can of spray lacquer and some glass microscope slides in the freezer until ready to use. Spray one side of the slide with the lacquer and hold outside in a gently falling snow. Put slides back into freezer to dry. Look at slides under a light or dissecting microscope.

REFERENCES/ADDITIONAL READING

Burt, William H. and Richard P. Grossenheider. 1980. Peterson Field Guide to Mammals. Houghton Mifflin Company. Boston, MA. 289 pp. (TLCPL)

Forrest, Louise R. 1988. Field Guide to Tracking Animals in Snow. Stackpole Books. Harrisburg, PA. 192 pp.

Marchand, P. J. 1991. Life in the Cold: An Introduction to Winter Ecology. University Press of New England. Hanover (no state given). 239 pp. (TLCPL)

Murie, Olas J. 1982. Peterson Field Guide to Animal Tracks. Houghton Mifflin. Boston, MA. 376 pp.

Stokes, Donald W. 1976. A Guide to Nature in Winter. Little, Brown and Company. Boston, MA. 374 pp. (TLCPL)

Stokes, Donald W. 1983. A Guide to Observing Insect Lives. Little, Brown and Company. Boston, MA. 371 pp. (TLCPL)

Stokes, Donald W. and Lillian Q. Stokes. 1986. A Guide to Animal Tracking and Behavior. Little, Brown and Company. Boston, MA. 418 pp. (TLCPL)

Williams, Terry T. and Ted Major. 1984. The Secret Language of Snow. Sierra Club/Pantheon Books. San Francisco, CA. (TLCPL)

CHILDRENS SCIENCE/TRADE BOOKS

Branley, Franklyn M. Holly Keller, Illustrator. 1986. Snow is Falling! Thomas Y. Crowell Co. New York, NY. (TLCPL)
The benefits as well as hardships of snow to plants and animals and people are discussed.

Cosgrove, Margaret. 1989. It's Snowing! Dodd, Mead and Co. New York, NY. (TLCPL)
Discusses the qualities of snow, how it is made and how it can be helpful or dangerous to plants, animals and people.

Hader, Elmer and Berta Hader. 1976. The Big Snow. Collier Books. New York, NY. (TLCPL)
How a big storm effects the animals and how humans interact.

Miller, Edna. 1970. Mousekin's Woodland Sleepers. Prentice-Hall. New York, NY. (TLCPL)
Mousekin has to find a different home for the winter. He visits hibernators and non-hibernators and learns about the dangers of winter.

Selsam, Millicent and Joyce Hunt. Normand Chartier, Illustrator. 1989. Keep Looking. Macmillan. New York, NY. (TLCPL)
The house looks empty. The yard looks empty. Snow covers the ground. But there are animals here. Where are they? Sit quietly, wait patiently and keep looking.

Data Sheet 1

Snow - How It Changes Life For Animals

Names _____

ANIMAL SIGN

1. Did you see any animal tracks? _____

2. Draw the tracks below.

3. Did you see any scat? _____

4. What kind of animal could the scat have come from?

5. Draw what the scat looked like.

6. Draw one or two other kinds of sign you saw and write their names in the boxes.

Data Sheet 2

Snow - How It Changes Life For Animals

	Temperature	Height
Shoulder Height		
Ground Level		0
Top of Snowpile		
Bottom of Snowpile		0

1. Draw what your two containers of snow looked like outside.

2. Draw what those containers looked after the snow melted.

Plants

- ☼ Growth Of Propagated Plants
- ☼ Native Versus Non-Native Plants

Growth Of Propagated Plants
How Does Your Land Lab Grow?

GRADE LEVEL/TOPIC: 2-3/Plants

TIME REQUIRED/RECOMMENDED SEASON: 90 to 120 minutes/Spring

SCIENCE SKILLS: Observing, Measuring, Mapping, Record Keeping

KEY WORDS: Seedling, Leaf, Bud, Branch, Shoot, Stem (Trunk), Grid, Scale, Height, Width (Spread), Centimeter, Growth

OVERVIEW

This Activity introduces the seedling, or juvenile stage, of the tree through measuring and scale drawing of young trees planted by the students. It consists of an introduction to tree growth and practice session using a grid (30-45 minutes), the use of a grid to measure and draw seedlings in the Land Lab (45-60 minutes) and a follow-up Activity, coloring and labeling the seedling drawings (15-30 minutes). This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.

PURPOSE

1. Students will observe the characteristics of a growing plant by measuring and recording its height, width, branching and buds.

2. Students will produce a scale illustration of a plant at known age based on data collected in the Land Lab.

MATERIALS

For The Class
- Growth Of Propagated Plants Data Sheet
- Master of Centimeter Templates to attach to rulers
- Practice Illustrations master
- Rubber cement or clear tape

For Each Student
- Illustration of square or other shape
- Growth Of Propagated Plants Data Sheets (2)
- Centimeter Template attached to a ruler or a ruler in centimeters
- Copy of Practice Illustrations handout
- Clipboard with pencil
- Crayons or colored pencils

Prepwork

Check the availability of plants for study from the Propagation Activity for grades K-1. Photocopy Growth Rate Of Propagated Plants Data Sheet, Centimeter Templates and Practice Illustrations masters, producing enough grids for two per student and enough templates and Practice Illustrations handouts for one per student. Cut apart the Centimeter Templates and distribute them to your students. Have your students cut them out and attach them to their rulers with rubber cement or clear tape. The template may also be attached to heavy paper if not all the students have rulers. Gather other necessary supplies.

BACKGROUND INFORMATION

The **seedling**, or juvenile stage, of a tree is probably the least studied and most vulnerable portion of its life history. Attempts to study this stage between the germination of the seed and the production of the first flower are hampered by the fact that the young plants are susceptible to drought and competition from more established plants and often do not survive it. In this Activity, your students will examine seedlings which they planted and tended and create a permanent record of the juvenile stage in drawing form.

The seedling begins when a healthy seed meets the right conditions (good soil, water, sunlight, warm spring days) and begins to **grow**. The seed absorbs water from the soil, and the embryo inside grows larger until a root tip breaks through the seed's hard outer covering, or seed coat. The root establishes itself in the soil with tiny root hairs which grow between the particles and absorb water and minerals. This steady supply of water and minerals to the seedling induces it to send a **shoot**, the future **stem** or tree **trunk**, up through the soil. (Braus, 1988)

The seedling generally breaks through the soil's surface within a few days and begins to grow **leaves** for food production. Food, water and minerals are transported to all parts of the seedling as new cells are added to its tissues. The addition of woody xylem cells which transport water from the roots upward causes the trunk to thicken. As the trunk widens, the tree is also growing taller from the tip of the trunk and from the tips of the branches. Terminal **buds** form at these tips. These buds consist of a tiny shoot, the next year's growth, which is enclosed in protective scales. In most trees, the buds form during the growing season and remain dormant until the following spring, when they sprout and become new **branches**. (Braus, 1988)

Plants grow slowly, especially trees. The seedlings observed during the first growing season will be small. Drawing these plants at their actual size would make it difficult to include any details. Therefore, in this Activity, a proportionate square method is used in which a grid aids the student in drawing each seedling at a larger scale. A **grid** is a pattern of horizontal and vertical lines forming squares of uniform size. In this Activity, the grid has two-centimeter square units, each representing one **centimeter** (0.394 inch) of the plant's actual size. The proportion of the representation or drawing to the plant which it represents (2 to 1, in this case) is known as the **scale** of the drawing. In making a map, a similar process is used to represent a large area of land at a much smaller scale. Field guides often use drawings at smaller or larger scale to illustrate characteristics of plants and animals while saving space or offering details.

Your students will use measurements to plot the following key characteristics of a seedling on the grid:

Height - the distance from the ground to the tip of its trunk.

Width (Spread) - the distance across its widest point, from tip to tip of the most far-reaching branches.

Branching - the locations of the attachment and the tip of each branch measured from the ground (to the attachment and to the tip) and from the trunk (to the tip).

They will use their observational skills to add such important details as the size and shape of any leaves, the location of any buds and the colors of the various parts of the seedling.

BEFORE YOU GO

1. Introduce to your students the growth pattern of trees as outlined in the background information. Explain that the purpose of making a scale drawing of a tree seedling in the Land Lab is to create a permanent record of its current stage of growth.

2. Describe the reasons for and the process of making a scale drawing, and have the students practice by making a scale drawing of a leaf. Distribute a Practice Illustrations handout, a Growth Of Propagated Plants Data Sheet and a clipboard with pencil to each student. Orient the students to the use of the ruler, identifying the metric side or Centimeter Template. Explain that every centimeter of length of the leaf will be represented by one square on the grid. Have the students measure the length and width of the illustration of the leaf and translate the data to the grid.

3. Explain that the students will be utilizing the same process to make a scale drawing of a tree seedling in the Land Lab. Define the measurements which they will use to translate the tree's features to the Data Sheet: height, width (spread) and branching. Instruct the students to practice taking the measurements on the illustration of the tree seedling and translating the details to their practice grid. Measurements may be recorded on the second page of the Data Sheet, if desired. Explain that every centimeter of the tree seedling will be represented by one square on the grid. Have the students measure the length and width of the leaves to assist in drawing them to scale.

4. When all of the students have finished their practice drawings, distribute a second copy of the Data Sheet to each student. Instruct them to take the Data Sheets, clipboards with pencils and rulers with them when they go outside.

PROCEDURE

1. Once in the Land Lab, have each student select a tree of known age, preferably one the student planted during Propagation Activity for grades K-1, and write the x-y coordinates of the plant on the Data Sheet for future reference.

2. Have each student measure his or her plant with the ruler and record in centimeters its height and width (spread) and the height from the ground of each branch at its attached end and its tip. Also have them measure the distance between the tip of each branch and the trunk of the tree. A place for recording data is provided on the second page of the Data Sheet.

3. Using the data, have each student draw a scale illustration of his or her plant on the grid with pencil, enlarging it to twice its actual size (1 centimeter on plant = 2 centimeters on grid). Have them note the location of all buds and leaves. Measuring the width and length of any leaves will assist the students in drawing them to scale. Have the students compare their drawings with the actual plants. When all students are satisfied with their efforts, return to the classroom.

CONCLUSION

1. In the classroom, have your students finish their scale drawings with color details as they observed them in the field. Discuss how accurately the students feel that they have represented their plants.

2. Have the students label the actual measurements of their plants on the drawings. Reinforce that these scale drawings based on observations in the field are an important record of their trees' growth.

JOURNAL QUESTIONS

Include your drawing in your journal, or make a 1-cm grid and draw the tree seedling that you studied, showing its actual size.
Make a drawing of what you think this seedling will look like next year.

EXTENSIONS

1. **Monitoring Growth.** Have your students repeat this Activity using the same or a similar plant over the course of the spring. Have them record any changes that they observe in color, size, branching and buds. Suggest that they draw the plant to show actual size for later comparisons.

2. **Details, Details, Details.** Have the students include in their drawings all of the features observed in the field, including bud scales, scars and other markings. Call their attention to the varying shades of color, and encourage them to try to duplicate the colors in their drawings. Have them label all parts in the drawings.

3. **Seedling Sleuths.** Have your students exchange drawings and try to locate someone else's actual seedling in the Land Lab. Discuss the details in the drawings which helped them to identify specific trees.

REFERENCES/ADDITIONAL READING

Braus, Judy, editor. 1988. Ranger Rick's NatureScope: Trees Are Terrific! National Wildlife Federation. Washington, DC. pp. 25-26. (TLCPL)

Hunken, Jorie, and The New England Wild Flower Society. 1993. Botany For All Ages: Discovering Nature through Activities for Children and Adults. The Globe Pequot Press. Old Saybrook, CT. 184 pp. (TLCPL)

Roth, Charles E. 1984. The Plant Observer's Guidebook: A Field Botany Manual for the Amateur Naturalist. Prentice-Hall, Inc. Englewood Cliffs, NJ. pp. 17-20, 68-70.

CHILDREN'S SCIENCE/TRADE BOOKS

Braithwaite, Althea, author. Barbara McGirr, illustrator. 1988. Tree. Life-Cycle Books. Longman Group USA, Inc. (TLCPL)
Illustrates how an acorn grows into an oak tree.

Gibbons, Gail. 1984. The Seasons of Arnold's Apple Tree. Harcourt Brace Jovanovich. San Diego, CA. (TLCPL)
Read about how the apple tree grows and changes.

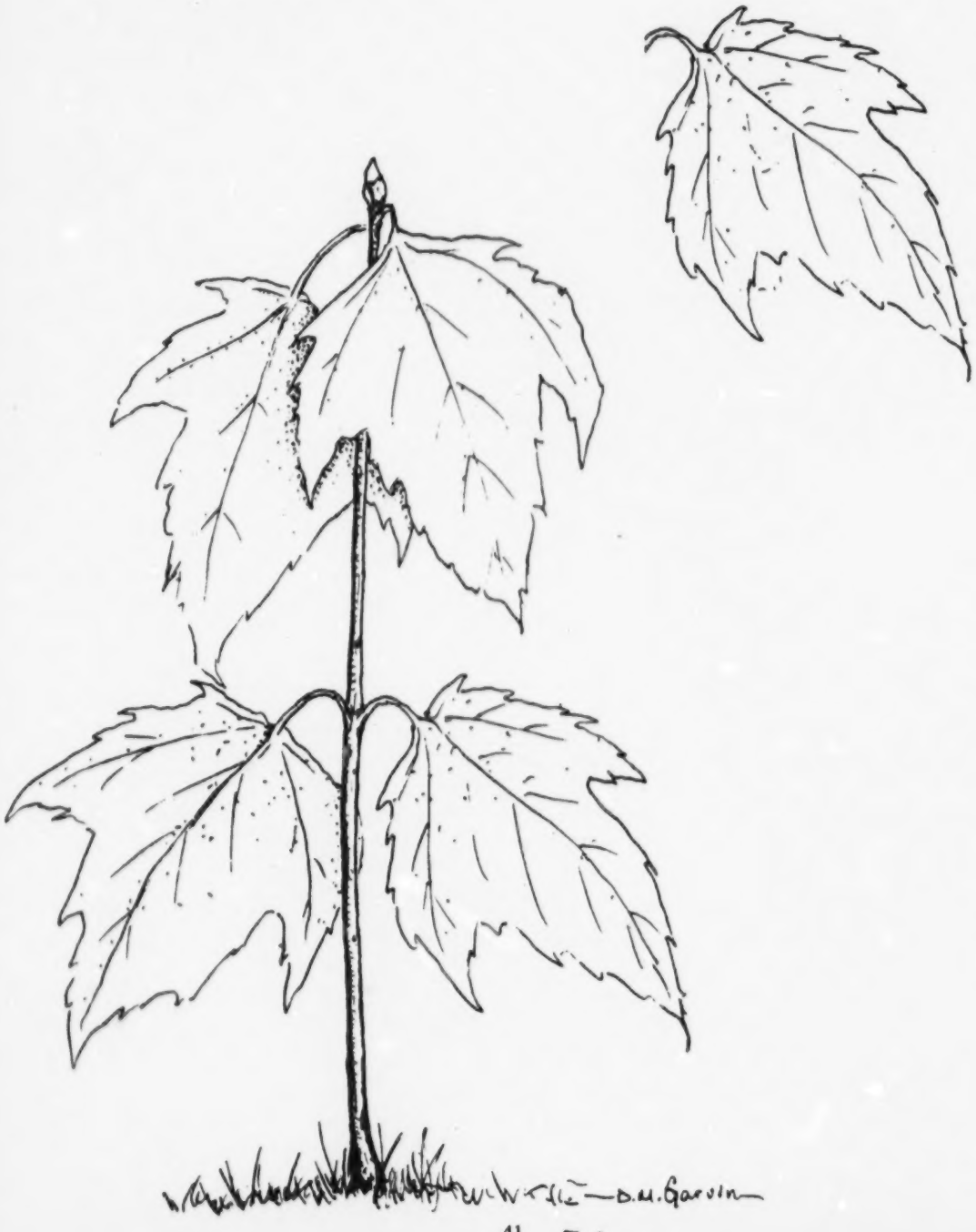
Jaspersohn, William, author. Chuck Eckart, illustrator. 1980. How the Forest Grew. Read-Alone Series. Greenwillow Books. New York, NY. (TLCPL)
The life cycle of a forest and its dependent wildlife is related in rich detail

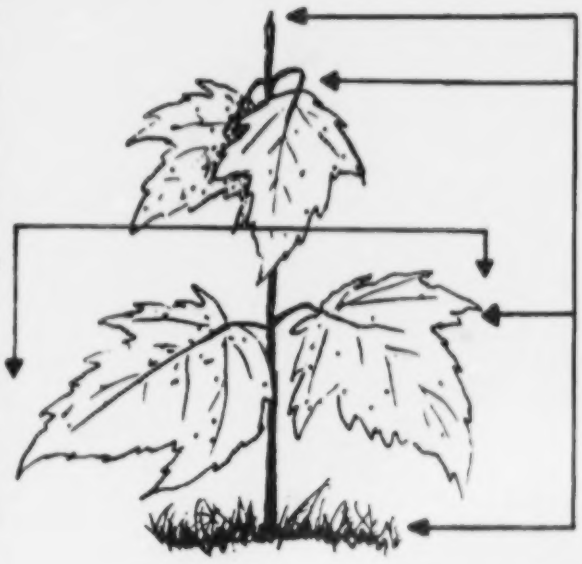
Thornhill, Jan. 1991. A Tree in a Forest. Simon and Schuster Books for Young Readers. New York, NY. (TLCPL)
Presents the life story of a 200 year old maple tree.

Tresselt, Alvin, author. Henri Sorensen, illustrator. 1992. The Gift of the Tree. Lothrop, Lee and Shepard Books. New York, NY. (TLCPL)
Traces the life cycle of an oak tree and describes the animals that depend on it for shelter and food.

Information Sheet

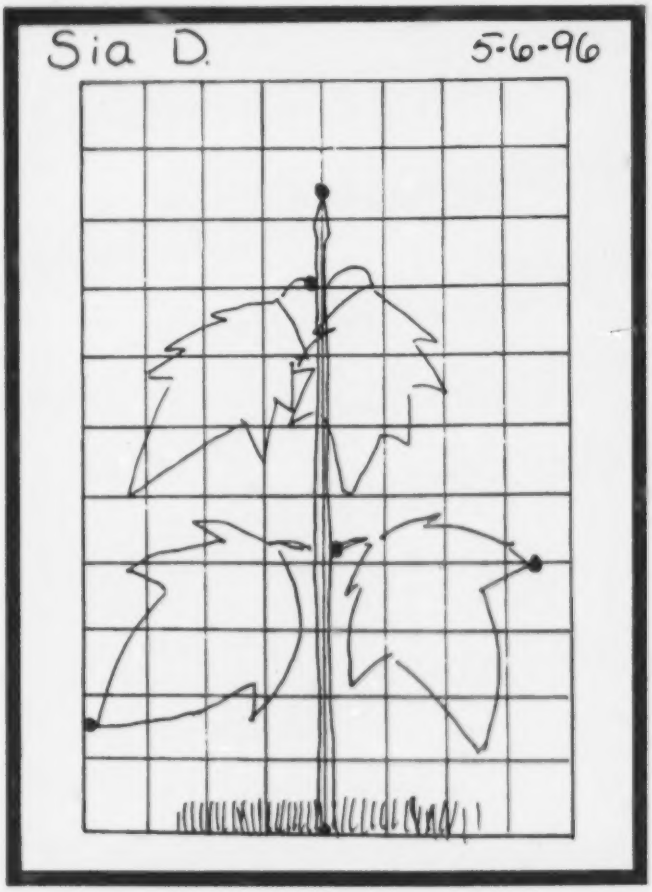
Practice Illustrations Master





Tree Seedling

Scale Drawing of a Tree Seedling

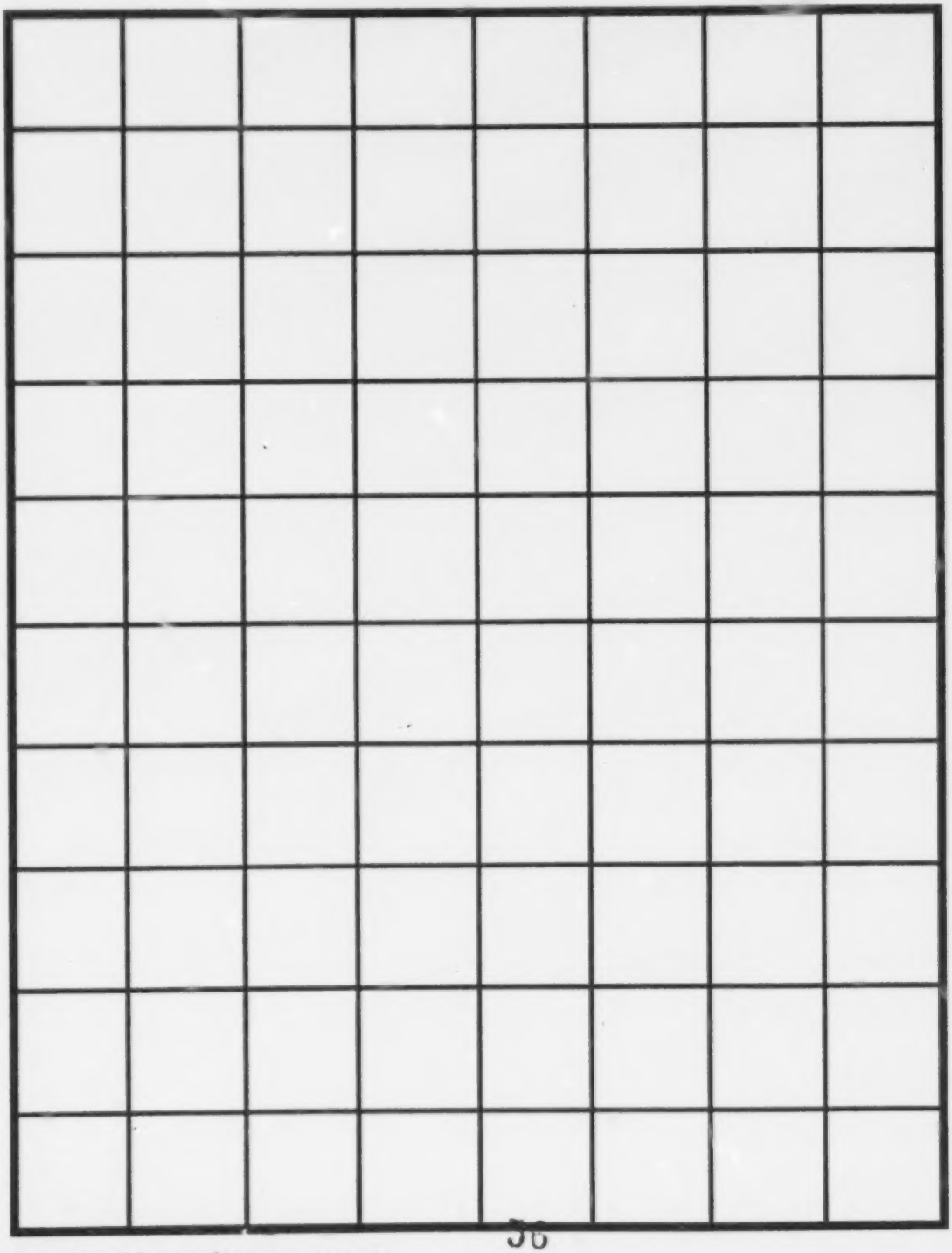


55

Data Sheet- Page 1

Growth of Propagated Plants

Name _____ Date _____ Coordinates _____



36

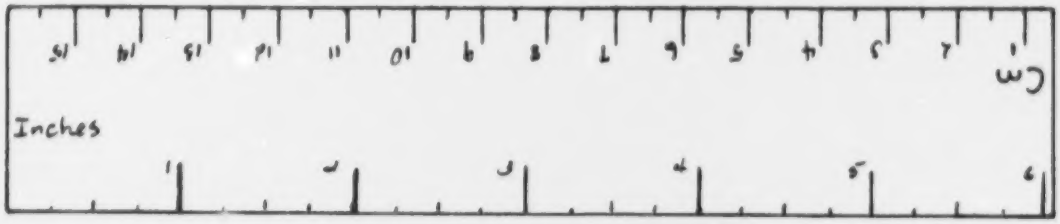
See other side to write measurements.

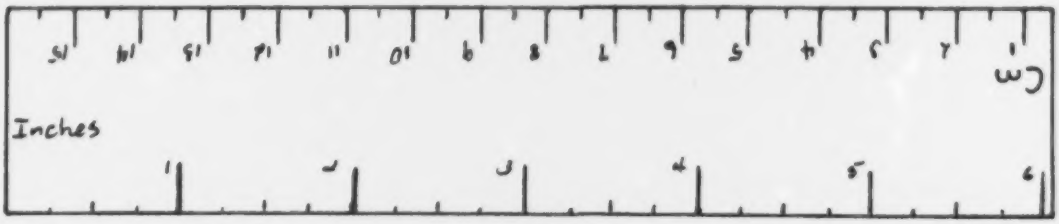
Data Sheet - Page 2 **Growth of Propagated Plants**

Height	
Width	
Branch Height - Trunk	1. 2. 3. 4.
Branch Height - Tip	1. 2. 3. 4.
Distance - Trunk to Branch Tip	1. 2. 3. 4.
Type of Plant	

Information Sheet

Centimeter Template





Native Versus Non-Native Plants
Alien Invaders

GRADE LEVEL/TOPIC: 2-3/Plants

TIME REQUIRED/RECOMMENDED SEASON: 85 minutes over two or more sessions, four weeks apart/ Spring

SCIENCE SKILLS: Observing, Censusing, Sampling, Record Keeping, Mapping

KEY WORDS: Quadrat, Natives, Aliens, Non-natives, Adaptation, Experimental, Control, Regeneration, Census, X-Y axis, Average

OVERVIEW

In this Activity, you and your students will delineate one or more experimental plots and an equal number of control plots (20 minutes). The students will use a removal technique to census the dandelion population (25 minutes) on each experimental plot. If desired, the above two activities can be performed on separate days. Students will return to the experimental plot(s) in four weeks to observe the short regeneration time of these fast-growing non-native plants (30 minutes). If this is your first Activity, please consult the Introduction.

Dandelion

PURPOSE

1. Students will recognize that non-native plant species have physical and structural characteristics which make them successful(common).

2. Students will use removal techniques and censusing skills to demonstrate why alien species are successful.

MATERIALS

For The Class
- 5-gallon buckets (3-5)
- Woodchip mulch (from Land Lab)
- Meter stick
- Large zip locked bags (about 1 for every 3-4 students)

For Each Student
- Data sheets (2)
- Clipboard and pencil
- Copy of Common Non-Native Plants Handout
- Sheet of white paper
- Crayons or markers

Prepwork

Photocopy enough copies of the Common Non-Native Plants Handout so that each student has one. Pull a dandelion plant from the soil to show class typical alien plant characteristics. Decide how many sets of quadrats you would like to work with and their location within the Land Lab.

BACKGROUND INFORMATION

Most people feel they have good reason to not like "weeds." Weeds, mostly **alien (non-native)** plants, are perceived to be ugly, have thorns and generally get in the way of peoples' activities. However, instead of hating these plants we should at least admire them for their ability to spread over this continent within a relatively short period of time. Consider some of the better known weeds: Dandelion, Burdock, Thistle, Plantain and Queen Anne's Lace. These plants are found virtually everywhere, and are testaments to the adaptability of plants. Many alien plants have historically been grazed by herbivores. The physical characteristics that make alien plants good weeds also ensured their survival when being grazed by herbivores.

Ecologists define **native** plant species as those that were here when the Europeans first settled this area. Therefore, non-native plant species are those plants that were not here before European settlement.

Interestingly, alien plants have adaptations that allow them to grow in harsh environments and produce many offspring. These physical characteristics include a long tap root, which can reach deep into the soil to provide water for the plant during the dry summer months. This long tap root is usually quite brittle (you know this if you have ever tried to pull up dandelions) and breaks off instead of coming completely out when the plant is pulled. That small amount of root left in the soil will quickly **regenerate** into a new dandelion plant. Also, alien plants start growing earlier in the season than native plants. Some plants, such as burdock and Queen Anne's Lace, are biennials, meaning they have a two year life cycle. They have a large rosette of basal leaves the first year that overwinter and start growing quite early in the spring. This means that alien plants can shade out native plants and keep those natives from growing and competing with the aliens for sun and water. Most other alien plants are perennials (they come up year after year from the same rootstock), which also begin to grow early in the spring to get a jump on the competition for sunlight and water. Finally, aliens are very good at reproducing. They usually produce many flowers and copious amounts of seed, most of which usually ends up germinating.

There is an obvious question about alien plants. If alien plants are considered weeds, are difficult to control and do not seem to serve any economic purpose, how did these plants get to this country? The answers are food, medicine and simple human error. The dandelion, for example, was brought to this country as a food plant. It was easy to grow, its leaves provided much-needed vitamin C, a wine could be made from the leaves and the root could be dried, roasted and used as a coffee substitute (Dobelis, 1986). The history of most other alien plants can be similarly traced.

In this Activity, students will be counting, or **censusing** the number of dandelions in a small portion of the Land Lab called a **quadrat**. The size of the quadrat is flexible. If you want to keep it simple, one large quadrat measuring about 2 meters on a side as an **experimental** plot is fine. A similarly sized control plot needs to be placed close to the experimental plot. The **control** plot acts to show students what the experimental plot would have looked like had there been no treatment (in this case, pulling up of the dandelions). If your class is more advanced, have them work in pairs or small groups to delineate their own set of plots, where the control and experimental quadrats each measure one square meter. The number of dandelions pulled will be counted at the start of the experiment and after four weeks.

BEFORE YOU GO

1. Introduce the concept of alien plants by referring to them as aliens that have invaded this area. A fake news flash format, read out loud in an urgent voice quickly gets their attention. Something like:

"Aliens are taking over!! They are extremely aggressive, they have large bodies are low to the ground and are very resistant to being poisoned. They reproduce quickly and have many children. This could mean trouble for the Natives."

2. Show students the dandelion, noting the long tap root and broad basal leaves. Pass out the Alien Plant Illustrated Handout and ask students if they have ever seen the plants illustrated. Discuss the characteristics of alien plants that make them so successful (see Background Information, above).

3. Decide how many control and experimental plots you would like your class to establish and investigate. Have at least one set of plots. If desired, show class a map of the Land Lab and where their plots will be located.

4. Distribute clipboards, pencils and enough zip locked bags to hold all of the dandelions from the experimental plot. Take class outside.

PROCEDURE

1. Using their handouts, have students identify alien plants. Note that most of these "alien invaders" have several characteristics that make them quite numerous in an early-successional-stage area such as your Land Lab. Optional: Have students check off each species of alien invader.

2. Show students how to pull a dandelion. Grasp the plant by its base and pull. The plant will break off, leaving some of the root in the ground; this is OK. Most, if not all of the dandelions pulled this way will regenerate, demonstrating the hardiness of alien plants.

3. Fill the buckets with woodchip mulch and bring them to the area at which the two quadrats are to be set up side-by-side. Using the meter stick as a guide, pour the mulch in a more or less straight line around the outside of the two quadrats. This does not have to be exact, although the quadrats should be roughly the same size. If using more than one set of quadrats, repeat this process for all quadrats. You have just delineated, or measured out, your quadrats, congratulations!

4. Designate one of the quadrats as the experimental and one as the control.

5. Instruct students to use landmarks in the Land Lab to illustrate the location of the quadrats on their Data Sheet. If your Land Lab is labeled on an **x-y axis**, students can include the nearby post numbers or letters.

6. Students make a visual comparison of the numbers of dandelions in the quadrats. Each student then places an "X" on the Data Sheet to mark the general location of each dandelion in both quadrats.

7. Instruct students to pull all of the dandelions from the experimental quadrat(s) and put them into the zip locked bags. Return to classroom.

8. Repeat steps 6 and 7, using another copy of the Data Sheet, after about 4 weeks have elapsed.

CONCLUSION

1. The short amount of time it takes dandelions to regenerate underscores their adaptability. What were some of the characteristics the students observed that make dandelions successful alien invaders?

2. What number do the students think will be higher, the number of dandelions pulled from the experimental plot before or the number pulled after the four weeks had elapsed?

3. Have students graph the number of dandelions pulled before and after the four weeks. Compare the two figures. What does this information tell us about the regeneration power of alien plants? Do all plants show this characteristic?

Optional: Repeat step number 3 by pooling (adding up) the number of pulled dandelions for all experimental quadrats and dividing by the number of experimental quadrats.
Optional: Divide the total number of plants by the number of experimental plots. This will give an average number of plants per plot. Discuss what an average is.

4. Look at how the dandelions are distributed within the experimental plot before and after pulling the plants. Is there any difference? Is there a difference in the physical appearance of the plants before they are pulled and after they have grown back?

5. If we wanted to, what would be a good way to get rid of dandelions in the Land Lab?

JOURNAL QUESTIONS

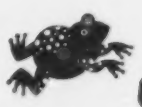
Write your own story about an "Alien Invasion."
List characteristics that would make an animal or plant of your choice adapt to a new environment.
Write about other things you could find out using quadrats.
Knowing characteristics that make alien plants so successful, draw the ultimate alien plant. This ultimate alien plant should have at least two of the characteristics mentioned in the Background Information. Paste the drawing in your journal.
Use words or pictures to explain the steps you took to accomplish this Activity.

EXTENSIONS

1. **Here We Grow Again.** Try replanting pulled dandelions and observe what happens. Try the experiment pulling only the leaves of the dandelion and leaving the roots in the ground.

2. **Historical Uses Of Plants.** Do research into what various plants were used for, or at least the natural history of some alien or native plants.

3. **Plant Math.** Using the average number of dandelions per square meter, calculate how many dandelions are in the entire Land Lab.



4. **Airborne.** Noting how dandelions disperse their seeds, can the students think of other plants that utilize this method? What are some other ways that plants disperse their seeds so that they do not sprout close to the parent plant?

5. **How Do You Measure Up?** Using a centimeter ruler, have students measure a sample (about 10) dandelion plants before they are pulled. Measure ten more plants (not necessarily the same 10) after the four weeks. How much have the plants grown?

REFERENCES/ADDITIONAL READING

Agricultural Research Service of the U.S. Department of Agriculture. 1971. Common Weeds of the United States. Dover Publications, Inc. New York, NY. 463 pp. (TLCPL)

Dobelis, Inge N., Ed. 1986. Magic and Medicine of Plants: A Practical Guide to the Science, History, Folklore and Everyday Uses of Medicinal Plants. Reader's Digest. Pleasantville, NY. pp. 1-47, 268. (TLCPL)

Stokes, Donald W. and Lillian Q. Stokes. 1985. A Guide to Enjoying Wildflowers. Little, Brown and Company. Boston, MA. 371. (TLCPL)

CHILDREN'S LITERATURE/ TRADE BOOKS

Cooney, Barbara. 1982. Miss Rumphius. Trumpet Club. New York, NY. (TLCPL).
Miss Alice does what she can to make the world more beautiful.

Meyers, Christopher and Lynne B. Meyers. Normand Chartier, Illustrator. 1991. McCrephy's Field. Houghton-Mifflin. Boston, MA. (TLCPL)
What happens when an abandoned farm goes back to nature.

Pereny, Constance. 1991. Growing Wild: Inviting Wildlife Into Your Backyard. Firefly Books. Willowdale, Ontario. (TLCPL)
When the yard of an abandoned house "goes to seed" the neighbors discover it attracts birds, squirrels, butterflies and other garden animals.

Silver, Donald M. Patricia J. Wynne, Illustrator. 1993. One Small Square - Backyard. Scientific American. New York, NY.
Take a close look at just one small square of earth.

Data Sheet

Alien Invaders

Names _____

_____

Date _____

1. Circle one: First Time Out Second Time Out

2. Below is an outline of the two quadrats. Make an X at the location of each dandelion.

3. Write the number of X's on the control side. _____

4. Write the number of X's on the experimental side. _____
(this number should equal the number of dandelions in the plastic bag).

5. Total number of dandelions pulled by the entire class.

63

Information Sheet

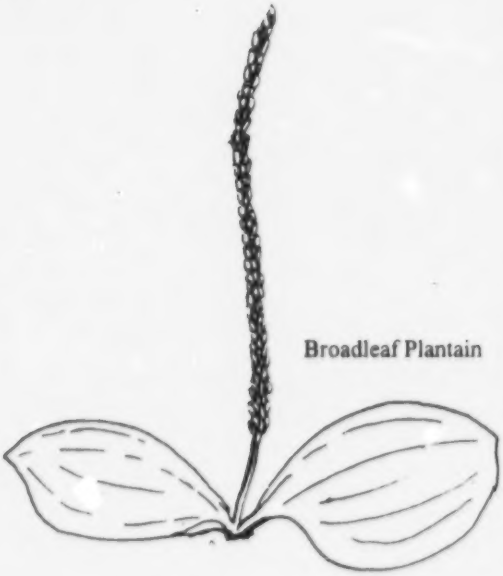
"Common Non-Native Plants"

Burdock

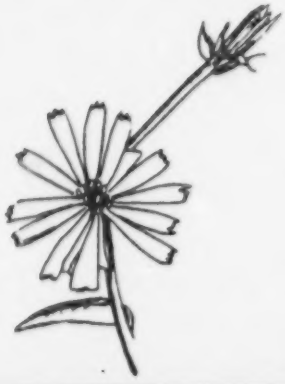
Teasel

Dandelion

Buckhorn Plantain



Broadleaf Plantain



Chicory

Animals

- **Food Preferences Of Neighborhood Birds**
- **Common Insects Which Use Plants**

Food Preferences of Neighborhood Birds

If You Were The Early Bird, Would You Eat a Worm?

GRADE LEVEL/TOPIC: 2-3/Animals

TIME REQUIRED/RECOMMENDED SEASON: 60 minutes initially, then 5-10 visits of 30 minutes each over the next several weeks /Winter

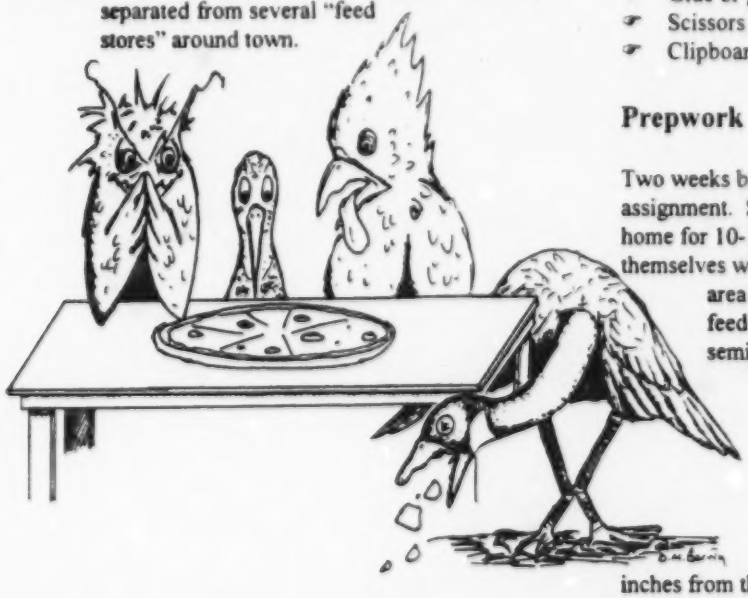
SCIENCE SKILLS: Observing, Collecting and Recording Data, Experimental Design

KEY WORDS: Preference, Niche, Generalist, Specialist, Millet, Sunflower Seed, Overwinter, Feeding Station

OVERVIEW

In this Activity, students will be separating out different kinds of seed found in a commercial mix of bird seed (30 minutes). The class will be using the seed and simple feeders made from plastic containers to establish a feeding station in the Land Lab (4-10 visits of 10-30 minutes each). Students will also be monitoring the feeding behavior of neighborhood birds (1-5 visits of 15-30 minutes each). Feel free to break this Activity up into smaller lessons. If this is your first Activity, please consult the Introduction.

**If desired, you can purchase bulk seed that is already separated from several "feed stores" around town.



PURPOSE

1. Students will determine food preferences and preferred feeding locations of birds by establishing feeding stations at two heights with two different foods.

2. Students will use information gathered in preference tests to select the best locations for permanent bird feeding stations.

MATERIALS

For The Class

- 20 pound bag of commercial bird seed containing sunflower and other seed**
- *Peterson's First Guide to Birds* (in your PARK-IT! library)
- Gallon-sized zip locked bags (about 12)
- Pie tins or paper plates (about 12)
- Spray paint, colored tape OR colored contact paper (two colors)
- Candle, matches
- Measuring cup
- Hammer and small nails
- Exacto knife
- Permanent marker

For Each Student

- 2-liter pop bottle
- Nail with a flat head or thumbtack
- Sandwich bag or paper cup
- Data Sheet
- Glue or gluestick
- Scissors
- Clipboard and pencil

Prepwork

Two weeks before this Activity, give students the following assignment. Students should observe their bird feeder at home for 10-15 minutes a day for one week to familiarize themselves with the birds that come to bird feeders in this area and their behavior. Students without bird feeders at home can make one by cutting a semicircle out of a 2-liter pop bottle and use some seed purchased for this Activity (see illustration).

About a week before this Activity, ask your students to bring in one or two 2-liter pop bottles. Use an exacto knife to make a small slit in each bottle four inches from the bottom of the bottle. You or your students can then poke their scissors in the slit and cut off the bottom

to produce the bird feeder. To facilitate the nailing of feeders to fenceposts, you can poke a hole about one inch from the rim of each container (a small nail held over the flame of a candle and then poked through the plastic will work). Install two drainage holes with the candle and nail. Write each student's name on his/her feeder with permanent marker.

If you have trouble procuring enough containers, this Activity can be easily modified so that two or three students observe the same feeder. This method will use less seed as well.

To facilitate easy identification of seed types in the field, the containers should be colored in some way. Leave half of them blank, and color the other half with colored tape, contact paper or paint on the outside of the container. Color the side of the container opposite the nail hole. Decide if the colored feeders will hold sunflower seed OR "other" seed.

If desired, go to the Land Lab without your class to decide where the feeding station will be located. The feeding station should be situated in a corner.

BACKGROUND INFORMATION

Songbirds are quite entertaining and bring color and life into our backyards. To attract birds, many people have set up **feeding stations** in their backyards. In fact, backyard bird feeding is one of the top recreational activities in the nation. In addition to learning their preferences, we can also learn about these little creatures by studying their behavior.

Birds are **sight-oriented** animals. Some people find it surprising to learn that birds have excellent color vision which they use to recognize members of their own and members of other species and to find food. Their sense of smell is usually weak or absent. The exception to this is the Turkey Vulture, which does use its sense of smell to find carrion. Birds are quite varied in their diets, with some eating fruit, some, seeds and others, meat. Birds look for and eat their food in different places, too. Some birds, such as Dark-eyed Juncos, look for food on the ground. Others, such as Goldfinches, like to hang onto branches or the perches of feeders as they feed. Others like to take food from one place and eat it in a sheltered location, such as Chickadees and Nuthatches. Finally, there are species like the House Finches, that will eat a variety of foods from a variety of locations. We call the Juncos, Chickadees and Nuthatches **specialists** because they have a definite preference to feeding location. House Finches are classified as **generalists**.

The factors of food preference and location contribute to what ecologists call the **niche** of an animal. In theory, no two species can occupy the same niche in nature. Moreover, when two species of animal compete for the same resources in the same places, one species will eventually change its habits to avoid competition. One example is hawks and owls. They compete for the same food resources, mostly small mammals, but are active at different times of the day and thus do not occupy the same niche.

The diets of birds are variable throughout the year. Birds such as Chickadees and House Finches take advantage of the abundance of insects during the summer months. When winter comes, these non-migratory birds **overwinter** here and change their diet to one of seeds. Some insect-eating birds, such as the warblers, do not change their diet with the seasons. When autumn comes, the warblers **migrate** to more tropical regions and continue to feed on insects. The third strategy for surviving winter, hibernation, is not known to occur among birds.

BEFORE YOU GO

1. Ask students what birds eat. How do we know this? Ask students where birds find their food. Again, how do we know this? The answer to both questions is that someone at some time went out and watched the birds to determine their preferences. Based on the two factors of food type and food height, ask the students how they would set up an experiment to see what the neighborhood birds like to eat and where. First, would they set up a feeder next to a busy street? Why? We know that some birds like to eat on the ground and some do not. Where should the feeders be located?

2. Pour some commercial bird seed on a paper plate. Show students that commercial seed consists of several kinds of seeds. Why do they think this is? Tell students they will be placing feeders with different kinds of seed in different places in the Land Lab to see who eats what where.

3. Divide your class into groups of three. Give each group one gallon-sized zip locked bag and a pie tin or paper plate. Give each student a sandwich bag or paper cup filled with bird seed. Students should pick out the sunflower seeds and put them onto the pie tin or paper plate. The resulting seed without any sunflower seeds should be poured into the gallon-sized zip locked bag. Have them continue until all seed is sorted by type. Go around to each group and empty their pie tin of sunflower seeds into a zip locked bag.

4. Pool each groups' seed types into gallon-sized zip locked baggies so that your class has baggies filled with sunflower seeds and "other" kinds of seeds.

5. Explain to the students that they will be establishing a feeding station consisting of two different kinds of seeds set at two different heights (ground level and on the fence). They will visit the feeding station on a regular basis for the duration of the study to count the number of birds feeding on each kind of seed and at each height.

6. Distribute a Data Sheet to each of your students. Have the students glue small samples of each of the seed types to the circles marked "seeds" at the top of the Data Sheets (see Data Sheet). Have your students mark their names on the Data Sheets and then hand in the sheets for later use.

7. When you are ready to move on to the Procedure, pass out the feeders. Explain that the ones with colored tape, contact paper or paint will hold one kind of seed. Those feeders without color will hold the other kind of seed. Make sure students' names are on feeders.

PROCEDURE

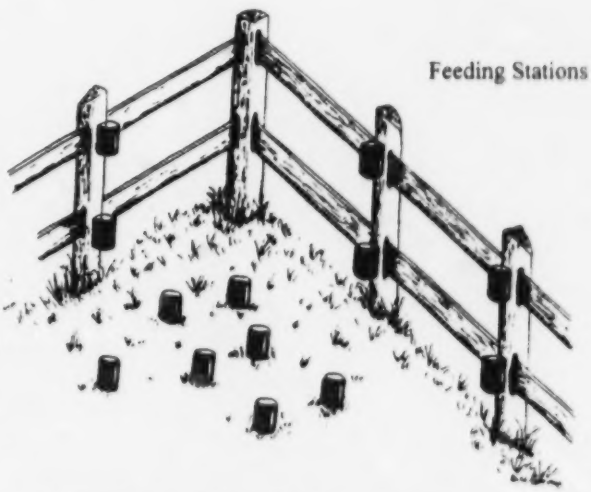
First Time Out

1. Have your students carry the following items to the Land Lab:

- Two large baggies of separated seed
- Measuring cup
- Feeders
- Thumbtacks or nails
- Hammer

2. If you have not done so already, decide where in the Land Lab your class will establish the feeding station. The feeding station should extend out in both directions from a corner about 4-6 fence posts (see illustration).

3. Divide your class into two groups, the Ground Group and the Fence Group, in reference to where the feeders will be placed. Fill half of the Ground Group's feeders, about 1/2 way, with sunflower seed and the other half with "other" seed, according to the color on their feeders. Within the Ground Group and the Fence Group, there should be about equal numbers of colored and non-colored feeders. This should result in four sub-groups, combining location and seed type: sunflower seed-fence, sunflower seed-ground, "other" seed-fence and "other" seed-ground.



Feeding Stations

4. Fill the Ground Group's feeders, about 1/2 way, with the appropriate seed and instruct them to place the feeders on the ground at least 2 meters (6 feet) apart.

5. Nail or tack feeders of the Fence Group on the inside of the vertical fence posts. Attach one or more feeders per fence post. Cluster feeders holding one kind of seed together for easier data collecting. Fill each feeder with the appropriate kind of seed.

6. Instruct the students to circle the appropriate words on their Data Sheets to describe their feeder. For example, "Fence, sunflower seed." For ease of relocating their feeders later, have students write down the fence number or letter that their feeder is near or on.

7. Leave site and reseed as necessary for one to four weeks or until birds have established it as a feeding site. Note if any feeders are damaged and replace accordingly.

8. Once inside, collect Data Sheets for subsequent use.

Subsequent Trips (Collecting and Recording Data)
1. Distribute clipboards, pencils and Data Sheets so that each student receives his/hers back. Bring more separated seed to restock feeding sites.

2. Set up observation times for the class that are about 10-30 minutes long. Birds are usually more active in the morning.

3. Using their Data Sheets to locate their feeders, students should pick a point in the Land Lab from which to observe their feeders.
Note: Stress to the students that there will be more birds to see if the students are quiet and far enough away as not to be a threat to the birds. Students should be at least 15 meters (40 feet) away.

4. Using their individual Data Sheets, each student should record the number of birds seen at his/her feeder. Time five 30-second periods during which each student makes one tally mark on his/her Data Sheet for each bird seen at his/her feeder. This amounts to counting the birds five times. Say, "Count all the birds at your feeder, now," and then say "Stop" after 30 seconds. Students write down a tally mark for each bird seen. Feel free to change the amount of time students use for counting birds to suit your situation.
Optional: Instead of counting the number of birds at the feeders, count how many times the different kinds of feeders get emptied. Graph this information.

5. Encourage students to notice color, size, stripes on wings and other bold markings. Can they use *Peterson's First Guide to Birds* to identify any of the birds?

CONCLUSION

1. In the classroom, have students add up the number of birds they saw at their feeders.

2. Pool the information by creating four headings on the board that correspond to the four location/seed type combinations (see Procedure #3). Instruct each student to put their answer to #3 on the Data Sheet under the appropriate heading on the board.

3. Have the class add up the number of birds in each of the four location/seed type combinations to arrive at one number for each combination. Students should record these four numbers as the answers to #4 on their Data Sheets.

4. Instruct students to construct a graph of this information, with "number of birds" along the y axis and the four "location/seed type" combinations along the x axis

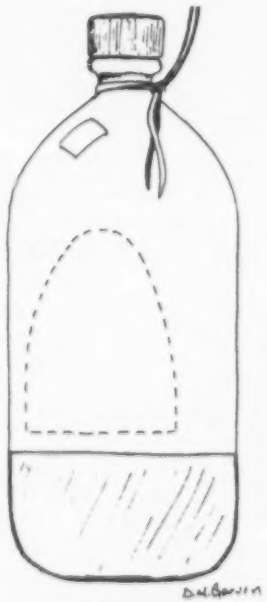
5. Based on their graphs, what combination of location and seed type resulted in the most bird visitors? Can the students tell if more birds fed on the ground or on the fence posts? Can the students tell if more birds ate the sunflower seed or the "other" seed?

6. Based on the information gathered from this experiment, what recommendations can the students make with regard to the type of seed to use and the location of a hypothetical permanent bird feeding station?

7. If desired, discuss characteristics of birds observed in the field. Emphasize color, relative size, markings and any noise that individual birds make. Try to identify birds observed by using your class' *Peterson's First Guide to Birds*. Did anyone notice one kind of bird only eating one kind of seed? Or, did any one kind of bird feed only on the ground or on the fence?

JOURNAL QUESTIONS

Paste your Data Sheet and your graph in your journal.
What kind of food would I eat if I were a bird?
Write a story called, "A Day in the Life of Chester Chickadee"
If you were a bird, where would you find food if there were no bird feeders?



2-Liter Bird Feeder (Extension #1)

EXTENSIONS

1. **"Cheep" And Easy.** A simple bird feeder can be made by using an exacto knife to poke a hole in a 2 Liter pop bottle about 4 inches up from the bottom. After the hole is made, students or the teacher can insert scissors to cut a semi-circle piece of plastic from the bottle (see illustration).

2. **Cornell Laboratory Of Ornithology.** Sponsors two programs: Project Feeder Watch and the Seed Preference Test. Both involve observing birds and bird behavior, and then completing forms to be mailed back to Cornell. Their address is:

Cornell Lab of Ornithology
159 Sapsucker Woods Road
Ithaca, NY 14850
(607) 254-2440

3. **Make A Permanent Feeding Station In The Land Lab.** Consult the books listed below or your local library for information on building your own permanent feeders.

4. **I Didn't Know They Did That.** Where are the birds coming from and going to when they feed at the Land Lab? Set aside time to observe birds to try to answer this question.

5. **Preference Studies By Species.** This experiment can be repeated while taking into account the species of birds using each feeder.

6. **What Do They Eat? Check Out Their Beaks And Feet!** Many bird's diets can be ascertained from observing their beaks and feet. Provide pictures or go on-line or to the Library to investigate.

REFERENCES/ADDITIONAL READING

Ericson, Louise. 1994. For the Birds: An Uncommon Guide. Pfeifer-Hamilton. Duluth, MN. 375 pp. (TLCPL)

Harrison, Hal H. 1975. Peterson Field Guide to the Birds' Nests. Houghton Mifflin. Boston, MA. 257 pp. (TLCPL)

Peterson, Roger T. 1980. A Field Guide to the Birds. Houghton Mifflin. Boston, MA. 384 pp. (TLCPL)

Robbins, Chandler S., Bertel Bruun and Herbert S. Zim. 1983. Birds of North America. Golden Press. New York, NY. 360 pp. (TLCPL)

Scott, Shirley L., Ed. 1987. Field Guide to the Birds of North America. National Geographic Society. Washington, D.C. 464 pp. (TLCPL)

Weidensaul, Scott. 1991. The Birder's Miscellany: A Fascinating Collection of Facts, Figures and Folklore from the World of Birds. Simon and Schuster. New York, NY. 135 pp. (TLCPL)

CHILDREN'S LITERATURE/ TRADE BOOKS

Arnosky, Jim. 25 Birds Every Child Should Know. Bradbury Press. New York, NY. (TLCPL)
Crinkleroot shows youngsters the best way to get started bird watching.

Bash, Barbara. 1990. Urban Roosts: Where Birds Nest in the City. Sierra Club. San Francisco, CA. (TLCPL)
Describes birds that make their homes in the heart of the city and examines how they have adjusted to the harsh city environment.

Hurd, Edith T. Clement Hurd, Illustrator. 1977. Look for a Bird. Science I Can Read Series. Harper and Row. New York, NY. (TLCPL)
Tips for identifying birds.

Oppenheim, Joanne. Barbara Reid, Illustrator. 1986. Have You Seen Birds. Scholastic. New York, NY. (TLCPL)
Depicts birds through the year.

Pallotta, Jerry. Edgar Stewart, Illustrator. 1986. The Bird Alphabet Book. Charlesburg. Watertown, MA. (TLCPL)
Introduced the letters of the alphabet by describing a bird for each letter.

Parsons, Alexandra. Jerry Young, photographer. 1990. Amazing Birds: Eyewitness Juniors. Alfred A. Knopf. New York, NY. (TLCPL)

Data Sheet

Food Preferences of Neighborhood Birds

Name _____ Date _____

1. Paste samples of seeds below

Sunflower Other

2. Circle the words that describe your feeder. Write the word on the line to the right.

a. Feeder location: Ground Fence _____

b. Seed Type: Sunflower Other _____

c. Post number or Post letter _____

3. Count the number of birds at your feeder five times. Put one tally mark for each bird you see when your teacher says, "Go."

4. Other Totals:

71

Common Insects Which Use Plants

Look Who's Been Eating My Land Lab

GRADE LEVEL/TOPIC: 2-3/Animals

TIME REQUIRED/RECOMMENDED SEASON: 90 to 120 minutes/Spring

SCIENCE SKILLS: Observing, Record Keeping, Identifying, Model Building

KEY WORDS: Insect, Head, Thorax, Abdomen, Wings, Antennae,Exoskeleton,Egg,Larva,Nymph,Pupa,Adult, Metamorphosis,Incomplete Metamorphosis, Complete Metamorphosis,Habitat,Camouflage,Sign,Gall,Egg Cases, Cocoon, Chrysalis

OVERVIEW

Insects are an integral part of any landscape. They are an important food source to many wildlife forms and are necessary for many plants to achieve pollination. Students will build insect models in the classroom (30-45 minutes) and visit the Land Lab for an insect species inventory based on their explorations (30-45 minutes). The Activity concludes with an in-class, follow-up discussion and the coloring of the census sheets (30 minutes). This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.

Oak Apple Gall

PURPOSE

1. Students will give examples of insects which use plants.

2. Students will identify "signs" on plants which indicate current or past insect use.

3. Students will recognize the characteristics of typical insects by building and using an insect model.

MATERIALS

For The Class

- Insect Bingo Board master
- Insect Model master
- Insect field guide

For Each Student

- Section of egg carton with 3 egg cups in a row (See illustration.)
- 23-centimeter (9-inch) pipe cleaners (4)
- Crayons
- Copy of Insect Model diagram with wing and eye cutouts
- Glue or glue stick
- Scissors
- Copy of Insect Bingo Board

Optional: Brightly colored popsicle sticks or marking stakes to mark interesting insect locations

Prepwork

Photocopy one copy of the Insect Bingo Board for each student. Request students bring in empty egg cartons before this Activity. Cut the egg cartons into sections of three egg cups. Photocopy on brightly colored paper one Insect Model diagram with cutouts per student.

BACKGROUND INFORMATION

Insects are the most numerous animals on the planet. They can be found on all the continents and in every medium Earth has to offer; air, water, soil, and in plant and animal tissue. Scientifically speaking, insects are animals that have 3 pairs of legs and 3 body parts: head, **thorax** and **abdomen**. Many insects also have **antennae** (one is an antenna) as adults. These are used to gather sensory information. Many, but not all, insects have

wings as adults. Spiders are commonly mistaken for insects but have 4 pairs of legs and only 2 body parts: cephalothorax and abdomen.

They have no bony skeleton in their bodies. Adult insects have a hard shell called an exoskeleton. This **exoskeleton** acts as an outside skeleton. When it is too small, the insect sheds it in favor of a newer, larger one which has been growing beneath the old one. **Note:** These characteristics will come in handy when it is time to build the insect models.

Baby insects always hatch from **eggs**. The baby may look like a smaller version of its parents. Most of the time it looks completely different. An insect's life is made up of a series of developing stages. **Metamorphosis** is the process by which a newly hatched insect develops into adulthood. There are two kinds of metamorphosis: Incomplete (simple) and Complete.

Incomplete metamorphosis occurs when a nymph hatches from the egg. A **nymph** looks like a miniature version of its parents without wings. As it gets older, it gets bigger and grows wings. Grasshoppers, praying mantises, mayflies and dragonflies are all examples of insects which develop through incomplete, or simple metamorphosis.

Complete metamorphosis is a bit more involved. A soft, worm-like baby, or larva is hatched from an egg. As it grows, it becomes a bigger worm-like **larva**. Before it can become an adult, the fully grown larva must enter the **pupa** stage. This is usually done within a cocoon or chrysalis. During its pupa stage the young insect does not eat or drink. Some pupae look like stiff, unmoving mummies. They may stay as pupae for less than two weeks or for as long as half a year depending on what kind of an insect they are. The winged **adult** that develops from the pupa stage does not look at all like it did as a pupa or as a larva. Examples of insects which have complete metamorphosis include butterflies and moths, bees, wasps, hornets, ants, beetles, mosquitoes and flies.

Insects are small animals which are often shaped and colored like their immediate surroundings. This is called **camouflage**. It helps insects hide from animals which would eat them and from animals which they hope to eat. A well-camouflaged insect can be almost impossible to see. Fortunately, insects in flight can be easily seen and so can the sign which many insects leave. **Sign** can also be clues which indicate the presence or passage of an insect. Insect sign can be a chewed leaf, a cast outer-shell, saw dust, tunnel entrances, egg cases, nests, cocoons and galls.

Egg cases, cocoons and galls are most easily found (and seen) in the winter. **Galls** are plant deformations caused by insects. Galls are very common and are caused by the actions and/or secretions of insects which lay their eggs in plant tissues. Galls are found on leaves, buds and stems and are grown by the plant around an insect egg or larva. Most galls are caused by small wasps and flies. Their young use them for food and protection while they are developing.

Cocoons are spun by larval silk moths to house and protect their pupa stage. A **chrysalis** is really the pupa of a butterfly. They can be found hanging upside down beneath the leaves of plants.

As your Land Lab continues to grow, it will be able to support more and more different kinds of insects. Over time it will produce varying **habitats** (food, water, shelter and space) for not only insects, but for the animals (reptiles, amphibians, birds and mammals) which eat them.

BEFORE YOU GO

1. Discuss common characteristics of insects and their life cycles. List or draw characteristics of an insect on the board. Discuss what is not an insect (spiders, ticks, pill bugs). This also may be a good time to explore the students' feelings about insects. It should be mentioned that while we find some insects repulsive, they are an important part of nature. Many insects are crucial to the production of fruit in trees. Others are food for other animals. Finally, remind your students that "nice" bugs such as ladybugs and butterflies are insects, too.

2. Introduce the idea of life cycles as a common trait among insects. If desired, draw a simple life cycle on the board. Many insects overwinter not as adults, but as eggs, larvae or pupae which are more durable. Discuss how this is a good idea for these cold-blooded animals.

3. After establishing what an insect is and is not, pass out the diagram and materials for students to construct insect models. A model is an object that represents another object; often it is a simplified version of the object. So, while this is an art project, it is also a tool for students to remember insect characteristics. A typical insect should have three body parts, six legs, wings, antennae and eyes. Encourage students to be as true to the characteristics as possible, but their insect does not have to be one found in nature. If desired, have each student point out what makes

their model insect-like. At this time, also encourage students to use the terminology to describe what they are talking about.

4. When their models are complete, explain to students that the class will be going out to the Land Lab to look for examples of insects and their sign. Pass out the Insect Bingo Board and go over each square to familiarize the students with common insects and sign they should look for. Insect signs are insect-related items that tell us insects are there or have been in the Land Lab. Instruct the students to make a check mark if the item on the Bingo Board is present. If you would like the students to take a census, they can keep a running tally of numbers of different kinds of insects and sign seen. Since insects are small and often secretive, review with students possible places to find insects. One would not expect to find insects out in the open unless they are flying. Therefore, encourage the children to get off the path, get on their hands and knees and to get their hands dirty turning things over searching for insects!

5. Discuss "insect etiquette." One of the most important concepts that the authors of this Guide want conveyed is a respect for all types of wildlife, insects and other creepy things included. Encourage your students to use primarily their eyes to collect information about the insects. Stress that rough handling such as squeezing or dropping an animal can hurt it, and when animals are hurt, they sometimes defend themselves by biting or stinging.

6. Hand out clipboards and pencils. Go outside.

PROCEDURE

1. Working alone or in pairs, children should fan out all over the Land Lab in search of insects and insect sign. Again, students should be encouraged not to pick up or handle insects. Students should mark in the appropriate box when they find something on the Insect Bingo Board.

2. If students find especially interesting items, give them colored popsicle sticks or marking stakes with which to mark the locations of the items.

3. After 20-30 minutes, gather students along the Land Lab fence and discuss everyone's findings. Ask children to identify whether the insects found are adults or not adults. Do this also for insect sign (cocoons belong exclusively to juvenile, or "not adult" insects).

4. Return to locations of colored popsicle sticks. Give students time to share interesting findings with their classmates.

CONCLUSION

1. Upon returning to the classroom, have students keep Insect Bingo Boards at their desks.

2. Review by having students name the insect or sign in each square and tell if it belongs to an adult or "not adult."

3. List on board or draw items found that were not illustrated on the Insect Bingo Board. Can students name the stage (egg, larva, pupa or adult) for each item that was found?

4. Discuss what was learned about insects that was not known before.

5. Color illustrations on the Insect Bingo Board. On the back of the sheets, have students make their own bingo boards using only insects seen in the Land Lab.

JOURNAL QUESTIONS

List some facts about insects that you had not known before.
Describe the insect you made. Tell what kind of food it would eat and what might eat it.
Why do you think insects have so many babies?
Name some animals that eat insects.

EXTENSIONS

1. **Cootie.** Review insect parts by playing the game Cootie with your students. Compare the Cootie insect with the models that the students made.

2. **It Takes Some Gall.** Because of their abundance and interesting process of formation, galls are a subject that can be studied in and of themselves. Many gall-making insects are so specific about their choice of host plant, one can sometimes identify the species of plant by identifying the galls on it. How many types of galls can you find? How many different parts of plants were they found on? For more information and some examples of common galls, see *Speaking of Trees...: 1995 Teachers' Resource Packet* compiled by the Naturalist Staff of the Ottawa Park Nature Education Center.

BEST COPY AVAILABLE

3. **Sounds Like A Land Lab To Me**. Were any insects heard in the Land Lab? What sounds were made? Have students recreate these sounds. Play Musical Chairs or Fruit Basket with insect sounds.
In Fruit Basket, the students are seated on chairs arranged in a circle with one student without a chair standing in the middle. The students are given a choice of four insect sounds from which they must select one to keep for the duration of the game. The student in the middle tries to find a seat by making one of the insect sounds. All students who have chosen this sound must change seats. No fair taking the seat next door or returning to the same seat! While the students are moving, the student in the middle tries to sit down as well. The student left without a seat is the new caller. If the student in the middle yells "Insects!", all students must change seats.

4. **Insect Riddles**. Have your students write insect riddles by listing clues about an insect's movement, sounds, habits, food source, etc. Give the students time to share their riddles and have their classmates guess the insect described.

5. **Other Creepy Crawlies.** Discuss other favorite creepy crawlies, especially spiders, with your students. Look for spiders and their webs in the Land Lab. Have your students make spider masks (template provided), and discuss how the spider's face is adapted for getting and eating food. For more information, see the Spider Observation Activity for grades 4-6.

REFERENCES/ADDITIONAL READING

Arnett, Jr., Ross H. and Richard L. Jacques, Jr. 1981. Simon and Schuster's Guide to Insects. Simon and Schuster. New York, NY. 511 pp. (TLCPL)

Borror, Donald J. and Richard E. White. 1970. Peterson's Field Guide to Insects. Houghton Mifflin Company. Boston, MA. 404 pp. (TLCPL)

Dashefsky, H. Steven. 1992. Insect Biology: 49 Science Fair Projects. TAB Books. Blue Ridge Summit, PA. 165 pp. (TLCPL)

Garvin, Denny, Linda Courter and Marilyn DuFour. 1995. Speaking Of Trees...: 1995 Teachers' Resource Packet. City of Toledo, Division of Forestry. Toledo, OH. Available in limited quantity from the Ottawa Park Nature Education Center, 2201 Ottawa Parkway, Toledo, OH 43606. (419)936-2876.

Headstrom, Richard. 1963. Adventures With Insects. Dover Publications, Inc. New York, NY. 221 pp.

Imes, Rick. 1992. The Practical Entomologist: An Introductory Guide to Observing and Understanding the World of Insects. Simon and Schuster. New York, NY. 160 pp. (TLCPL)

Leahy, Christopher. 1987. Peterson's First Guide to Insects of North America. Houghton Mifflin Company. Boston, MA. 128 pp.
(TLCPL)

LeFevre, David N. New Games for the Whole Family. Perigee Books. New York, NY. pp. 78 - 79.

Klots, Alexander B. and Elsie B. Klots. 1961. 1001 Questions Answered About Insects. Dover Publications, Inc. New York, NY. 260 pp. (TLCPL)

Milne, Lorus and Margery Milne. 1980. The Audubon Society Field Guide to North American Insects and Spiders. Alfred A. Knopf. New York, NY. 989 pp. (TLCPL)

Mound, Lawrence. 1990. Eyewitness Books: Insects. Alfred P. Knopf. New York, NY. 64 pp. (TLCPL)

CHILDREN'S SCIENCE/TRADE BOOKS

French, Vivian, author. Charlotte Voake, illustrator. 1993. Caterpillar, Caterpillar. Candlewick Press. Cambridge, MA. (TLCPL)
A girl learns about caterpillars and butterflies as she watches her grandfather grow them in his garden.

Holley, Brian, author. Diane Gruettner, Diane Black and Denis Gagne, illustrators. 1986. The Hayes Book of Bugs and Critters. Penworthy Publishing Company. Milwaukee, WI. (TLCPL)
Pictures and brief explanations describe a variety of insects, their sounds, habits, habitats and signs.

Lobel, Arnold. 1978. Grasshopper on the Road. I Can Read Series. Harper and Row. New York, NY. (TLCPL)
Grasshopper meets other types of insects so involved in Activity that they will not risk traveling with him.

Continued...

McDonald, Megan, author. Paul Brett Johnson, illustrator. 1995. Insects Are My Life. Orchard Books. New York, NY. (TLCPL)
No one understands Amanda's devotion to insects until she meets Maggie.

Pallotta, Jerry, author. Ralph Masiello, illustrator. 1986. Icky Bug Alphabet Book. Children's Press. Chicago, IL. (TLCPL)
Introduces the characteristics and activities of insects and other crawly creatures from A to Z, beginning with ant and concluding with the zebra butterfly.

Ryder, Joanne, author. Lynne Cherry, illustrator. 1989. Where Butterflies Grow. Lodestar Books. New York, NY. (TLCPL)
Describes what it feels like to change from a caterpillar into a butterfly.

Ryder, Joanne, author. Catherine Stock, illustrator. 1991. When the Woods Hum. Morrow Junior Books. New York, NY. (TLCPL)
The reader experiences the life cycle of the cicada through the eyes of a young girl.

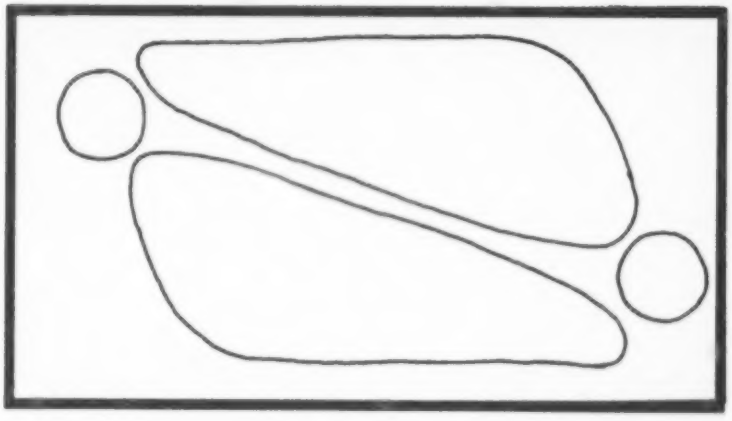
Information Sheet

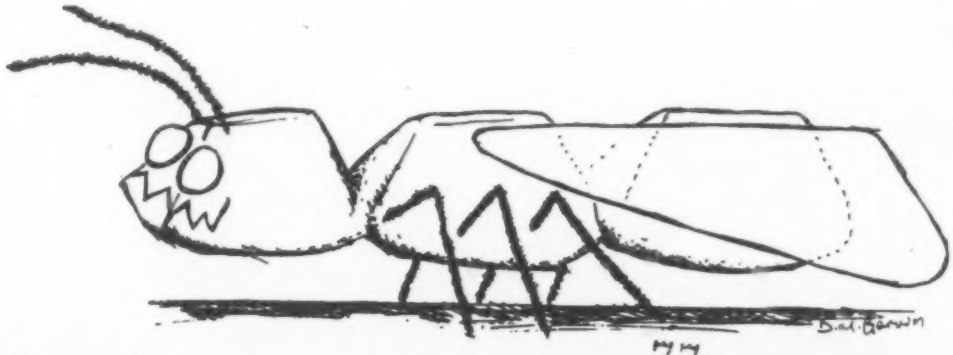
Insect Model

Egg Cups

Pipe Cleaners

Template: Wings & Eyes



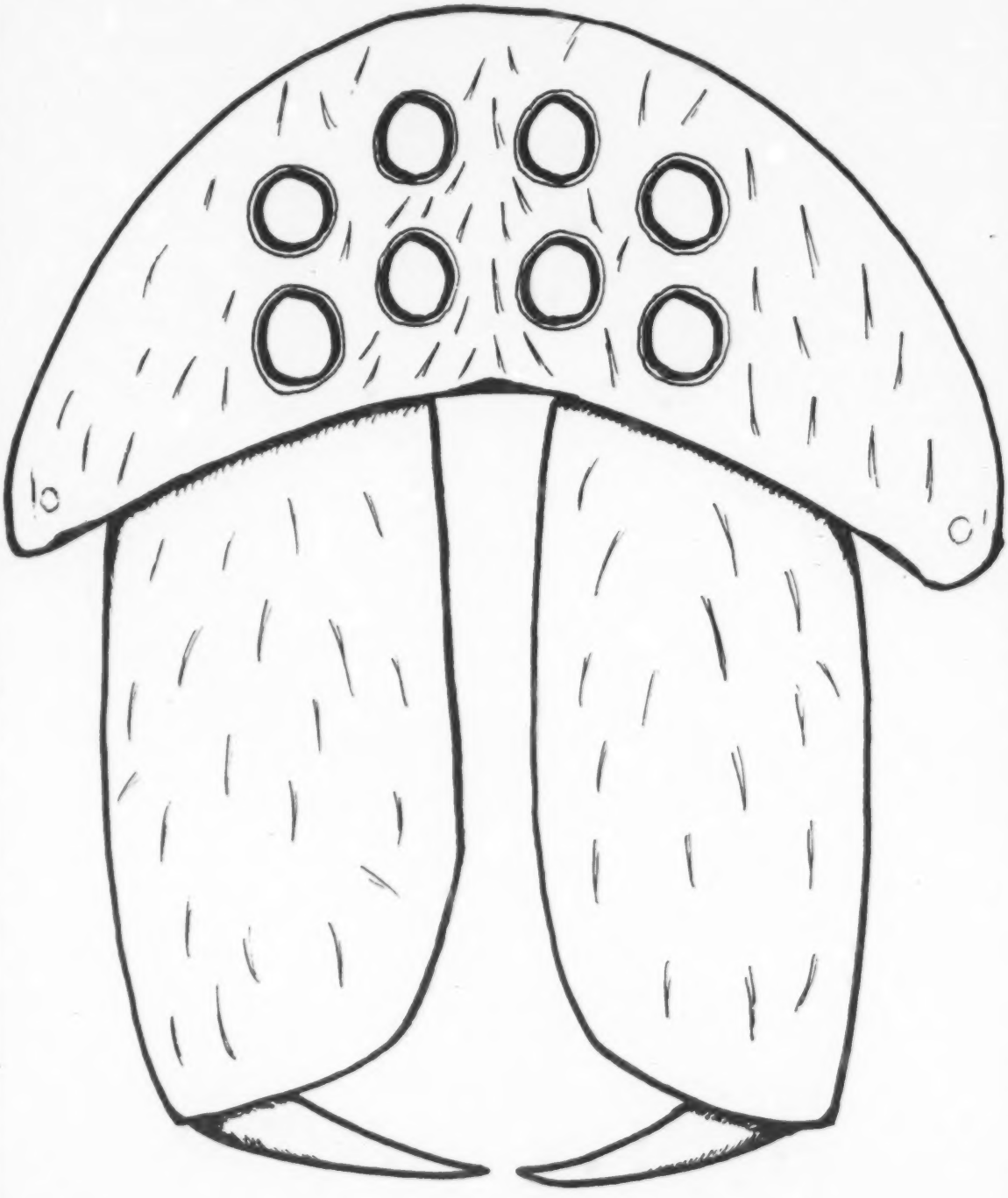


Completed Model

77

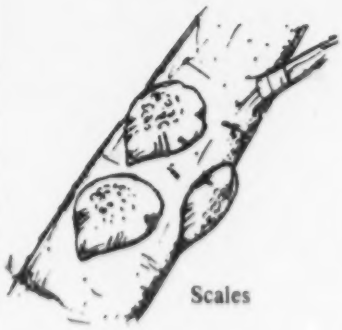
Information Sheet

Funnel Weaver Mask Template



Insect Bingo Board

Aphid

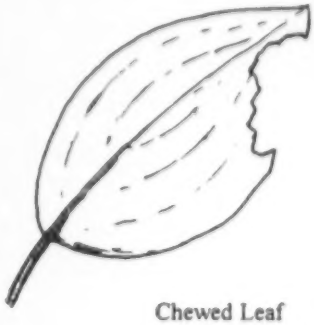


Scales

Cicada

Leaf Rollers

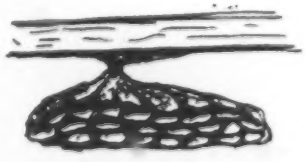
Spittle



Chewed Leaf

Oak Apple Gall

Praying Mantis Egg Case



Paper Wasp Nest

Appendix

Fourth Grade Proficiency Test
Learning Outcomes

1. Create and use categories to organize a set of objects, organisms or phenomena.
2. Select instruments to make observations and/or organize observations of an event, object or organism.
3. Identify and/or compare the mass, dimensions and volume of familiar objects in standard and/or nonstandard units.
4. Use a simple key to distinguish between objects.
5. Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.
6. Evaluate a simple procedure to carry out an exploration.
7. Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.
8. Evaluate observations and measurements made by other persons.
9. Demonstrate an understanding of safe use of materials and/or devices in science activities.
10. Explain the operation of a simple mechanical device.
11. Identify characteristics of a simple physical change.
12. Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.
13. Make predictions about the weather from observed conditions and weather maps.
14. Identify and/or describe the relationship between human Activity and the environment.
15. Identify evidence and show examples of changes in the earth's surface.
16. Demonstrate an understanding of the basic needs of living things.
17. Identify ways in which organisms react to changing environments.
18. Distinguish between living and nonlilving things and provide justification for these distinctions.
19. Analyze and/or evaluate various nutritional plans for humans.

Sixth Grade Proficiency Test
Learning Outcomes

PARK-IT!

1. Use a simple key to classify objects, organisms and/or phenomena.

2. Identify potential hazards and/or precautions involved in scientific investigations.

3. Make inferences from observations of phenomena and/or events.

4. Identify the positive and/or negative impact of technology on human Activity.

5. Evaluate conclusions based on scientific data.

6. Recognize the advantages and/or disadvantages to the user in the operation of simple technological devices.

7. Predict the influences of the motion of some objects on other objects.

8. Propose and/or evaluate an investigation of simple physical and/or chemical changes.

9. Provide examples of transformation and/or conservation of matter and energy in simple physical systems.

10. Identify simple patterns in physical phenomena.

11. Describe simple cycles of the earth and moon.

12. Identify characteristics and/or patterns in rocks and soil.

13. Demonstrate an understanding of the cycling of resources on earth, such as carbon, nitrogen and/or water.

14. Trace the transmission of energy in a small, simple system and/or identify the roles of organisms in the energy movement in an ecosystem.

15. Compare and/or contrast the diversity of ways in which living things meet their needs.

16. Analyze behaviors and/or activities that positively or negatively influence human health.

17. Analyze the impacts of human activity on the ecosystems of the earth.

This Project Would Not Be Possible Without
The Continuous Support Of

The City Of Toledo

Mayor
Carleton S. Finkbeiner

City Council
Gene Cook, President

June Boyd
Peter Gerken
Rob Ludeman
C. Allen McConnell
Betty Schultz
Edna Brown
Judy Jones
Robert McCloskey
Jeanine Perry
Peter Ujvagi
Gene Zmuda

James W. Barney, Director, Natural Resources Department
Ross Hamre, Commissioner, Forestry and Open Space Planning
Bob Behan, Administrator, Forestry

The Ottawa-Jermain Park Advisory Board

The Coca-Cola Bottling Company of Northern Ohio, Inc.

Paper Courtesy of
The Toledo Hospital

Printing Courtesy of
The Blade

Graphic Layout and Design by
Toledo Botanical Garden

SEAL · OF · THE · CITY · OF · TOLEDO ·
LABORARE · EST · ORARE
JANUARY · 7 · 1837 ·